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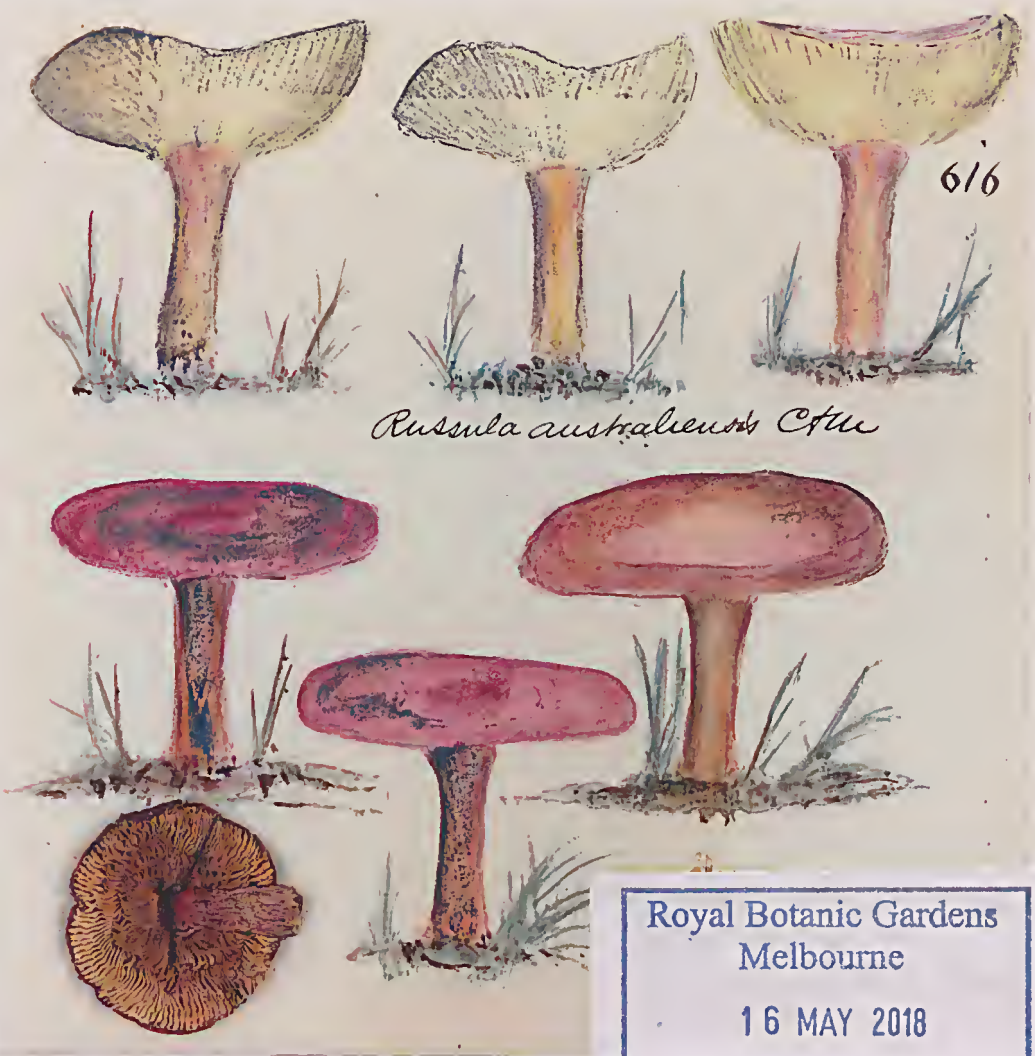
Muelleria

Plant, Algal and Fungal Taxonomy and Systematics

Vol 36, 2017–2018



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Russula australiensis **Cooke & Massee, *Grevillea* 16: 32 (1887)**
Source: State Botanical Collection [MEL2367999]
Illustration: Flora Martin née Campbell (1845-1923) (Imaged by A. Johnson)
In the 1800-early 1900s, fungi collections were often pressed like plants, and specimens then mounted (lower left) with illustrations. This is one of only three known collections of *R. australiensis*. Flora was a pioneer woman scientist who corresponded extensively with leading mycologists of the day. 183 of her fungal and botanical collections are in MEL.

Muelleria publishes research papers on Southern Hemisphere plant, algal and fungal taxonomy and systematics, particularly relating to Australia. Acceptable submissions include: taxonomic revisions; phylogenetic and biogeographical studies; short papers describing new taxa, documenting nationally significant new records, or resolving nomenclatural matters; historical analyses relevant to systematics; and any research contributing to our knowledge of plant, algal or fungal diversity. Special issues or reviews will be considered after discussion with the Editor.

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Editor's Note

T.Lebel

Editor in Chief: 2002–2012, 2015–2018

It is time to hand the Editorship over to someone new. I would like to say a sincere thank you to all those who have helped support our scientific publication, *Muelleria*, over the years. In particular the authors and reviewers, editorial staff, curation staff (MEL and other herbaria), and loyal subscribers. Thank you also to staff at SUBStitution, who have carefully typeset and printed volumes since 2003 and helped guide various changes in format of the journal over the years. Finally, appreciation for Dr Tom May, Editor (2013–2015) and Alison Vaughan, Production Editor (2012–2017), who initiated publication of papers online prior to print (Volume 34–current).

The content of the journal remains focussed on Australasian plant, algal and fungal taxonomy and systematics, the National Herbarium of Victoria (MEL) collections and collectors, and research contributing to our knowledge of plant, algal and fungal diversity. As the basis for most areas of biological research, taxonomy and systematics are an essential part of any research paradigm. It's a small niche, but there is still a vibrant space for specialist journals, with the potential to reach broader audiences through increased access and linking to other online science pages. We look forward to more research papers on intriguing topics being submitted for publication in *Muelleria*.

Teresa

Outgoing Editor in Chief, *Muelleria*

Muelleria

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Prasophyllum abblittiorum (Orchidaceae), a new distinctive species from north-western Tasmania

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Introduction

There are more than 100 species of *Prasophyllum* R.Br. currently accepted from Australia and New Zealand, with about half of these being described since 1989 by David Jones and his collaborators (Royal Botanic Gardens, Kew 2017). In addition, there are numerous informally named species, for example Rouse (2002), Jeanes and Backhouse (2006), Brown et.al. (2008). 30 formally named species are recorded from Tasmania (de Salas and Baker 2017) including 19 that are listed under the Tasmanian *Threatened Species Protection Act 1995*.

During surveys for orchids in the far north-west of Tasmania, a very distinctive new species of *Prasophyllum* (Figures 1-3) was discovered by members of the Abblitt family in October 2012, hereafter the "bush population". Interested individuals and the Wildcare Inc. group Threatened Plants Tasmania (TPT) subsequently assisted the Abblitt family with their surveys, and in 2013 discovered a second population of plants about 7 km from the site of the first discovery[1], hereafter the "road population". The new species differs markedly from all other species of *Prasophyllum* (Pridgeon et al. 2003) by (1) an unornamented petaloid labellum that lacks a central callus and reflexed tip (Figure 2); (2) pollinia that readily fragment (Figure 2); and (3) an elongated anterior lobe of the column in some flowers (Figure 3).

1 An image of a specimen taken by Roger Hay in 1995 has recently emerged, and this was located about 200 m away from the road population. This site is now long undisturbed, and no specimens were seen in the vicinity during a search in 2016.

Abstract

Prasophyllum abblittiorum P.A.Collier, is described as a new species that is very distinctive within the genus *Prasophyllum*, having flowers with an unornamented petaloid labellum, pollinia that readily fragment and an anterior lobe of the column in some flowers.

Key words: *Prasophyllum*, leek orchid, taxonomy

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Figure 1. *Prasophyllum abblittiorum* (image: Peter Fehre)

Materials and methods

In 2014, 2015 and 2016, TPT volunteers visited the two known populations and attempted to flag and then count every flowering specimen. Volunteers then divided into smaller groups, with each group being assigned a collection of flagged plants. One person in a group was responsible for gathering selected morphometric data from each plant, while another person recorded the data on a pre-prepared sheet.

Herbarium collections have been made at various times since the discovery of this species. The resulting dried and pickled material was examined at the Tasmanian Herbarium using a Leica A60 stereomicroscope. Type specimens and duplicates were gathered in October 2016. These were measured in the field; then additional morphometric measurements were gathered from freshly dissected material using a Leica S6 stereomicroscope and installed graticule.

Results

Population counts: the maximum single-day population counts for each year between 2012 and 2016 are shown Table 1. The total number of fertile plants seen over the three years is unknown because individual plants are not marked.

Data analysis: We aggregate the field data, except for six records that were duplicates which are averaged (excepting one record of flowering measurements that are clearly outliers) and exclude all data for leaf length where the leaves have been grazed. We use this aggregated data in the species description using the customary notation: $(q_1–)q_2–q_3(–q_4)$, where $q_2–q_3$ covers 95% of the range of values recorded, and q_1 and q_4 are omitted if they are equal to q_2 and q_3 respectively. For

Table 1. Maximum number of *P. abblittiorum* specimens counted during a single-day survey with a group of TPT volunteers, unless otherwise indicated.

	2012	2013	2014	2015	2016
Bush population	60†	41‡	60	71+2 leaves	82+1 leaf
Road population	N/A	14‡	27	20	24

† "Mum and I did a second count in 2012 because we found a few extras further up the hill .... I think we counted about 60." (Janine Cranney email 3/11/15).

‡ "We flagged and counted but we did not have a large [TPT] group and may have missed a few" (Malcolm Wells email 4/11/15)

Figure 2. *Prasophyllum abblittiorum* with dorsal sepal removed showing the unornamented petaloid labellum (behind the column) and fragmenting pollinia. (Image: Miguel de Salas)

plant characters not collected in the field, we aggregate the much smaller number of lab measurements from fresh, spirit and pressed specimens, and provide minimum and maximum measured values, unless indicated explicitly.

Taxonomy

Prasophyllum abblittiorum P.A.Collier, **sp. nov.**

***Type*: TASMANIA**. Arthur Pieman Conservation Area, 5km south-west of Marrawah, 22.x.2016, P. Collier 5654 (holotype: HO; isotypes AD, MEL).

Terrestrial tuberous herb usually growing singly. *Tubers* sub-globose to ovate forming a current and replacement pair. Current year's tuber 6–7.5 mm wide, 7–12 mm long in fresh specimens seen. *Leaf of fertile plant* (55–)70–200(–250) mm tall, erect, acicular with a long fine apex, (1.5–)2–5(–7) mm in diameter at the widest point, hollow, glabrous, narrower in infertile

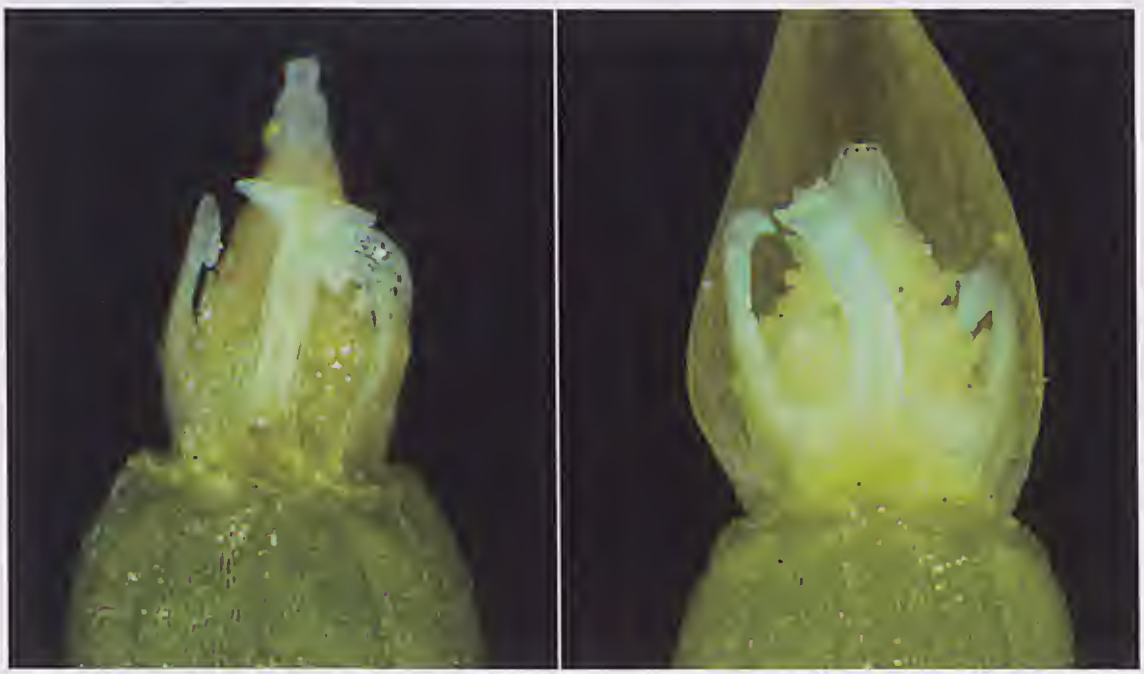

Figure 3. *Prasophyllum abblittiorum* flower with tepals removed showing two forms of the anterior lobe of the column. (Image: Miguel de Salas)

plants. *Peduncle* (50–)75–215(–250) mm tall; emergent through a membranous section of the leaf. *Inflorescence* a spike of (2–)3–11(–12) flowers. *Floral bracts* ovate-deltoid, 1.5–2.25 mm long, 1.25–2 mm wide, closely sheathing the short pedicel in lower flowers and base of the ovary. *Flowers* (3–)3.5–7 mm long, (2–)3–7.5 mm wide, consistently yellow-green, petals and labellum slightly paler than the sepals, all with 3–5 faint striae. *Dorsal sepal* ovate, 4–6 mm long, 1.75–3 mm wide, flat to shallowly concave, tip acute, thickened. *Lateral sepals* separate, lanceolate, (4–)4.5–7(–8) mm long, 1–2 mm wide, concave to involute, apex acute. *Petals* lanceolate, (3–)3.5–5.5(–7) mm long, 0.75–1.5 mm wide, shallowly concave, apex acute. *Labellum* unornamented, petaloid, lanceolate, 3.75–5.25 mm long, 1–2 mm wide. *Column* ovate 2.25–3 mm long, including acuminate rostellum about 0.5 mm long; *Hamulus* reflexed, linear about 1 mm long. *Column arms* linear, increasingly falcate towards the apex, a vestigial to well-formed basal lobe on the dorsal side, pale yellow-green fading to translucent at the margins and the apex, 1.5–2.5 mm long, up to 0.75 mm wide at the base, narrower at the apex. *Column anterior lobe* present or absent in flowers of the same spike, attached to the base of the column, linear, 1.75–2.5 mm long, up to 0.5 mm wide, translucent, apex truncate with lateral lobes up to 0.5 mm long at the apex, or shallowly to moderately v-notched, or minutely denticulate. *Anther* basifixed on the posterior side of the column, yellow-green with brownish markings, 1.25–2.25 mm long, 1–1.5 mm wide. *Pollinia* oval, fragmented in all collected specimens. *Ovary* obovate with 3 shallow ridges (2.5–)3–7(–8) mm long, 1.5–2.75 mm wide, expanding in the fruiting stage. *Stigma* a sticky patch towards the apex of the column. *Mature capsules* in two specimens seen 5.5–6.5 mm long, 3–3.5 mm wide, tending smaller in upper flowers. *Seed* often elongated, but highly variable in shape. *Testa* transparent, 0.4–0.6 mm long, 0.15–0.25 mm wide, comprised of elongated air-filled yellow-brown cells. *Embryo* relatively opaque, oval.

***Selected specimens*: AUSTRALIA: TASMANIA.** Arthur Pieman CA, 5km south-west of Marrawah, 28.x.2012, P. Collier and J. Cranney 5501 (HO); Arthur Pieman CA, 5km south-west of Marrawah, 2.xi.2013, D. Abblitt s.n. (HO575652); Arthur Pieman CA, Bluff Hill Road, between Bluff Hill Lighthouse and Arthur River Road, 3.xi.2013, M. Wells s.n. (HO5B542B); Arthur Pieman CA, 500 m south of West Point Road, 23.xi.2015, P.A. Collier 5601 (HO); Arthur Pieman CA, Bluff Hill Road, 22.x.2016, P. Collier 5653 (HO).

***Flowering period*:** Mid October to early November.

***Distribution and habitat*:** Known from two sites 7 km apart in the Arthur Pieman Conservation Area, between West Point Road and Bluff Hill Road. The habitat is wet heathland on quartz and sand, including some bare ground. The larger bush population occupies a gentle north-facing slope with total area of approximately 1400 sq. m. within a bounding rectangle of 125 m x 25 m. The smaller road population occupies a north-facing slope beside a gravel road in an area of approximately 100 sq. m. A list of co-occurring species at the bush population is in Table 2.

***Conservation status*:** *P. abblittiorum* satisfies criteria D to be listed as endangered under the Tasmanian Threatened Species Protection Act 1995, given that the total population is currently "estimated to number fewer than 250 mature individuals" (DPIPWE 2017). Additionally, the road population could be damaged

Table 2. Co-occurring species at the bush population of *Prasophyllum abblittiorum*

Shrubs	*Acacia suaveolens* (Sm.) Willd., *Allocasuarina zephyrea* L.A.S.Johnson, *Aotus ericoides* (Vent.) G.Don, *Banksia marginata* Cav., *Boronia pilosa* Labill., *Dillwynia glaberrima* Sm., *Epacris impressa* Labill., *Eucalyptus nitida* Hook.f., *Gompholobium huegelii* Benth., *Hibbertia prostrata* Hook., *Leptospermum scoparium* J.R.Forst. & G.Forst., *Leucopogon collinus* (Labill.) R.Br., *Philotheca virgatus* (Hook.f.) Paul G.Wilson, *Phyllota diffusa* (Hook.f.) F.Muell., *Sphaerolobium minus* Labill., *Sprengelia incarnata* Sm.
Herbs	*Amperea xiphoclada* (Sieber ex Spreng.) Druce var. *xiphoclada*, *Caladenia carnea* R.Br., *Cassytha glabella* R.Br., *Comesperma calycina* Labill., *Drosera peltata* Thunb., *Drosera pygmaea* DC., *Laxmannia orientalis* Keighery, *Opercularia varia* Hook.f., *Stackhousia viminea* Sm., *Stylidium gramineum* Sw., *Thelymitra aristata* Lindl., *Thelionema caespitosa* (R.Br.) R.J.F.Hend., *Prasophyllum pulchellum* D.L.Jones, *Pterostylis aphylla* Lindl., *Pterostylis tasmanica* D.L.Jones
Graminoids	*Baumea acuta* (Labill.) Palla, *Chordifex monocephalus* (R.Br.) B.G.Briggs, *Empodisma minus* (Hook.f.) L.A.S.Johnson & D.F.Cutler, *Hypolaena fastigiata* R.Br., *Lepidosperma filiforme* Labill., *Leptocarpus tenax* Labill., *Patersonia fragilis* (Labill.) Asch. & Graebn.
Fern and allies	*Lindsaea linearis* Sw., *Selaginella uliginosa* (Labill.) Spring

by road maintenance activities unless appropriate care is taken. While the two known populations are in a protected area that includes large areas of potentially suitable habitat, recent surveys and investigations have revealed only an old photographic record from near the road population.

Etymology: Named for the Abblitt family: Vicky Abblitt, daughter Janine Cranney and son Don Abblitt. Vicky and Janine discovered plants of this species in October 2012 and recognised them as being undescribed. During their frequent surveys in a voluntary capacity, the family have substantially increased our knowledge of the presence and distribution of orchids and other taxa in the far north-west of Tasmania. They frequently and willingly act as guides to many individuals and groups who have assisted their endeavours.

Discussion

Prasophyllum abblittiorum is morphologically distinct from any other known species of *Prasophyllum*. It bears only superficial resemblance with its overall green colour and/or relatively small stature to *P. lindleyanum* Rchb. f., *P. pulchellum* D.L.Jones and the '*P. macrostachyum* R.Br. - *P. gracile* Lindl.' group (Rouse 2002). The overall appearance of the known plants of *P. abblittiorum* is remarkably consistent, both in colour of the plants and morphology of the flowers. This may be due to plants being self-pollinated, unlike most *Prasophyllum* spp. that offer a nectar reward to pollinators. The fragile pollinia seen in nearly all flowers examined are consistent with a self-fertilisation hypothesis.

Orchids are well-known for producing peloric or pseudopeloric mutants where (1) replicas of the labellum replace the two petals, or (2) a replica of the petals or sepals replace the labellum (Bateman 1985). Indeed, Bateman (1985, p. 359) mentions the possibility that an "autogamous ... pseudopeloric founder can generate a large population of similar individuals" with a named variety of the variable European species *Epipactis phyllanthes* G.E.Sm. as an example. In contrast, *P. abblittiorum* is distinct from related species not only with its petaloid labellum, but also with friable pollinia, an anterior lobe of the column in some flowers and a consistent yellow-green colour. A few *P. pulchellum* plants have been found growing amongst the bush population, and a *P. favonium* D.L.Jones plant is known from near the bush population; neither are known from near the road population. The number of recorded individuals of *P. abblittiorum* vastly exceeds the number of these two named species, see Table 1. This evidence strongly suggests that *P. abblittiorum* is not a mutant of the second Bateman (1985) type above.

Acknowledgements

I thank Miguel de Salas from the Tasmanian herbarium for invaluable advice about structure and content of this paper, plus images of dissected flowers; Mark Wapstra for the list of the species that describes the habitat; and Peter Fehre for one of his images of a flowering plant. TPT volunteers assisted with surveys for the species and data collection. The anonymous referees helped with refining aspects of this paper.

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Nomenclatural changes and corrections for some previously described Australasian truffle-like fungi (Basidiomycetes)

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Abstract

Several new combinations and corrections to various names of Australian truffle-like fungi are made, and new Mycobank numbers assigned to updated nomenclature.

Keywords: sequestrate, *Russula*, *Oudemansiella*, new combinations

Introduction

Amendments to various names of Australasian truffle-like fungi are made herein. Some are new combinations to better show affinities of taxa to epigeal relatives, and to reflect changed understanding of phylogenetic relationships within different genera. Some new names are proposed as well to cover those taxa for which there are existing names, and names that are invalid for various reasons are validated.

In a special case, a databasing error at Mycobank (MB) created a curious situation in *Stephanospora* where the same MB number was issued to three different taxa named by different authors. Mycobank has resolved this by issuing new numbers for the affected taxa. The opportunity is taken to include this information in order to aid the dissemination of the changed MB numbers.

New combinations

OUDEMANSIELLA

Lebel & Catcheside (2009) revised the truffle-like genus *Cribbea*, providing molecular and morphological support for the placement of this genus in the Physalacriaceae. However, insufficient support for deeper branches in the phylogeny and ongoing broader discussions as to generic boundaries (ie *Hymenopellis* vs *Oudemansiella*, *Protoxerula*, or *Xerula*), meant that there was not a sufficiently strong case for moving species of *Cribbea* to one

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of the epigeal genera at the time (Lebel & Catcheside 2009). Petersen & Hughes (2010) made the choice to split the group and to recognize seven genera, four of them newly described, some of them distinctly not monophyletic, but morphologically distinct and homogeneous. The position of genera in their analyses depends upon the gene region the phylogeny is based upon. It is preferable to recognise three well supported monophyletic clades (ITS/LSU): *Xerula* s.str., *Paraxerula*, and *Oudemansiella* (inclusive of *Hymenopellis, Protoxerula, Ponticulomyces, Dactylosporina,* and *Cribbea*), rather than poorly supported paraphyletic clades (Park et al. 2017).

In this paper, we make the necessary nomenclatural changes to the truffle-like taxa that previously belonged to the genus *Cribbea*.

Oudemansiella andina (Speg.) T.Lebel & T.W.May **comb.nov.**

MB 820011

Secotium andinum Speg., *Anales Mus. Nac. Buenos Aires, Ser.* 3 1: 55 (1902)

Cribbea andina (Speg.) J.E.Wright & E.Horak, *Darwiniana* 12(4): 607 (1961)

No DNA sequence data are available, but microscopically the morphology of the spores and cystidia closely resemble those of other taxa in *Oudemansiella*.

Oudemansiella gloriosa (D.A.Reid) T.Lebel & T.W.May **comb. nov.**

MB 820012

Secotium gloriosum D.A.Reid, *Kew Bull.* [10]: 646 (1956) [1955], Queensland, base of rotten tree; Holotype: K(M) 4469!

Cribbea gloriosa (D.A.Reid) A.H.Sm. & D.A.Reid, *Mycologia* 54(1): 99 (1962)

Secotium lamellatum J.W.Cribb, *Pap. Dept. Bot. Univ. Queensland* 3: 107 (1956), Queensland, Holotype: K(M) 146567!

Cribbea lamellata (J.W.Cribb) A.H.Sm. & D.A.Reid, *Mycologia* 54(1): 101 (1962)

Synonymy of *Secotium lamellatum* with *S. gloriosum* was established by Lebel & Catcheside (2009).

Oudemansiella reticulata (J.W.Cribb) T.Lebel & T.W.May **comb.nov.**

MB 820013

Secotium reticulatum J.W.Cribb, *Pap. Dept. Bot. Univ. Queensland* 3: 108 (1956), Queensland; Holotype: K(M) 133178!

Cribbea reticulata (J.W.Cribb) A.H.Sm. & D.A.Reid, *Mycologia* 54(1): 103 (1962)

Oudemansiella turbinispora (P.S.Catches. & T.Lebel) T.Lebel & T.W.May **comb.nov.**

MB 820014

Cribbea turbinispora P.S.Catches. & T.Lebel, *Austral. Syst. Bot.* 22(1): 48 (2009), South Australia, *Catcheside 1590;* Holotype: AD!

RUSSULA

In all published phylogenies, sequences from sequestrate forms placed in *Cystangium, Elasmomyces, Gymnomyces* and *Macowanites* nest within *Russula* with strong support. Furthermore, the sequestrate forms do not form separate clades, but rather, the sequestrate species are scattered through the *Russula* clade, sometimes deeply nested (Lebel & Tonkin 2007; Miller et al 2001; Eberhardt & Verbeken 2004; Verbeken et al 2014). Therefore, the following sequestrate taxa, most recently placed in *Cystangium, Elasmomyces, Gymnomyces* or *Macowanites*, are transferred to *Russula*.

Russula balpinea (Grgur.) T.Lebel **comb. nov.**

MB 820015

Cystangium balpineum Grgur., *Larger Fungi S. Australia* 53 (1997). Mt Lofty, S.A., 29 Mar. 1924, *J.B. Cleland*; Holotype: AD 9757.

Russula bispora (T.Lebel) T.Lebel **comb. nov.**

MB 820016

Cystangium bisporum T.Lebel, *Austral. Syst. Bot.* 16: 373 (2003). Burraga Swamp Trail, Allyn Rd, Barrington Tops Natl Park, N.S.W., 28 Apr. 1992, *M. Castellano & J.M. Trappe H5648*; Holotype: DAR.

Russula boranupensis (T.Lebel) T.Lebel **comb. nov.**

MB 820018

Gymnomyces boranupensis T.Lebel, *Austral. Syst. Bot.* 16: 403 (2003). Point Rd, Boranup Natl Park, W.A., 20 Jul. 1993, *J.M. Trappe 14803*; Holotype: PERTH.

Russula capitis-orae (Dring) T.Lebel **comb.nov.**

MB 820020

Elasmomyces capitis-orae Dring, in Dring & Pegler, *Kew Bull.* 32(3): 564 (1978). Ghana: Cape Coast, 23 May 1975, *Rose 7523* (K(M), Holotype).

Cystangium capitis-orae (Dring) T.Lebel, *Mycotaxon* 81: 197 (2002)

Russula clavata (T.Lebel) T.Lebel **comb. nov.**

MB 820021

Cystangium clavatum T.Lebel, *Austral. Syst. Bot.* 16: 375 (2003). Kirrama, Qld, 9 May 1991, *M. Castellano, Y. Prin & N. Malajczuk H4721*; Holotype: BRI; isotype: MEL 2145888, PERTH.

Russula costatispora (T.Lebel) T.Lebel **comb. nov.**

MB 820022

Gymnomyces costatisporus T.Lebel, *Austral. Syst. Bot.* 16: 405 (2003). Deep R., Nuyts Wilderness, Walpole Natl Park, W.A., 22 Jul. 1993, *J.M. Trappe 14896*; Holotype: PERTH; isotype: MEL 2146440, PERTH.

Russula eburnea (T.Lebel) T.Lebel **comb. nov.**

MB 820023

Gymnomyces eburneus T.Lebel, *Austral. Syst. Bot.* 16: 408 (2003). Junction of Black Mountain Rd and Rams Horn Track (NE side), Alpine Natl Park, Vic., 17 May 1999, *J.M. Trappe s.n. (Claridge 2019)*; Holotype: MEL 2126522.

Russula eildonensis (G.W.Beaton, Pegler & T.W.K.Young) T.Lebel **comb. nov.**

MB 820024

Gymnomyces eildonensis G.W.Beaton, Pegler & T.W.K.Young, *Kew Bull.* 39: 680 (1984). Junction of Snobs Ck and Conns Gap, near Eildon, Vic., 3 May 1982, *K. & G.W. Beaton (Beaton 2)*; isotype: K(M).

Russula furcatispina (T.Lebel) T.Lebel **comb. nov.**

MB 820025

Gymnomyces furcatispinus T.Lebel, *Austral. Syst. Bot.* 16: 411 (2003). Burraga Swamp Trail, Allyn Rd, Barrington Tops Natl Park, N.S.W., 28 Apr. 1992, *T. Lebel H5653*; Holotype: DAR; isotype: MEL 2146443, PERTH.

Russula glarea (T.Lebel) T.Lebel **comb. nov.**

MB 820026

Gymnomyces glarea T.Lebel, *Austral. Syst. Bot.* 16: 412 (2003). Hellyer Gorge, Tas., 14 May 1991, *M. Castellano H4890*; Holotype: HO; isotype: MEL 2146460, PERTH.

Russula leucocarpa (T.Lebel) T.Lebel **comb.nov.**

MB 820035

Gymnomyces leucocarpus T.Lebel, *New Zealand J. Bot.* 40(3): 497 (2002). New Zealand, South Island, Buller, Matakitaki Bridge Scenic Reserve, *R.E. Beever*, 10 Aug. 1998; Holotype: PDD 69223.

Russula longispora (T.Lebel) T.Lebel **comb. nov.**

MB 820036

Gymnomyces longisporus T.Lebel, *Austral. Syst. Bot.* 16: 415 (2003). Bussel Hwy, Ludlow Natl Park, 5 of Capel, 19 Jul. 1993, *M. Castellano s.n. (J.M. Trappe 14716)*; Holotype: PERTH; isotype: MEL 2146444.

Russula luteobrunnea (T.Lebel) T.Lebel **comb. nov.**

MB 820037

Cystangium luteobrunneum T.Lebel, *Austral. Syst. Bot.* 16: 380 (2003). Big Tree Track, Lemonthyme, Tas., 12 May 1991, *M. Castellano H4845*; Holotype: HO.

Russula macrocystidia (T.Lebel) T.Lebel **comb. nov.**

MB 820038

Cystangium macrocystidium T.Lebel, *Austral. Syst. Bot.* 16: 380 (2003). Speeler Track, Cradle Mountain Natl Park, Tas., 13 May 1991, *M. Castellano H5032*; Holotype: HO; isotype: MEL 2146432, O5C, PERTH.

Russula mattiroloana (Cavara) T.Lebel **comb. nov.**

MB 820039

Elasmomyces mattiroloanus Cavara [as *'mattirolianus'*], *Malpighia* 11(9-10): 426 (1897)

Secotium mattiroloanum (Cavara) E. Fisch., in Engler & Prantl, *Nat. Pflanzenfam., Teil.* I (Leipzig) 1**: 301 (1900)

Macowanites mattiroloanus (Cavara) T. Lebel & Trappe [as *'mattirolianus'*], *Mycologia* 92(6): 1194 (2000). Toscana, Firenze, Tosco-Romagnolo Appenine Mountains, Vallombrosa forest, under Abies alba, summer 1896, leg. F. Cavara (FH-Dodge Herb. #2087 & NY-Zeller Herb. #1671, as isotypus of *Arcangeliella borziana*).

For further discussion of the type status of this taxon, view Vidal (2004).

Russula megaspora (Rodway) T.Lebel **comb. nov.**

MB 820040

Gymnomyces megasporus Rodway, *Pap. & Proc. Roy. Soc. Tasmania* 1925: 168 (1926)

Octaviania megaspora (Rodway) G.Cunn., *New Zealand J. Agric. Res.*, A. 22: 300B (1941)

Cystangium megasporum (Rodway) T.Lebel & Castellano, *Mycologia* 94: 335 (2002). Cascades, [Hobart], Tas., May 1925, *L. Rodway*; Holotype: K(M); isotype: HO 113639.

Russula parvisaxoides (T.Lebel) T.Lebel **comb. nov.**

MB 822047

Gymnomyces parvisaxoides T.Lebel, *New Zealand J. Bot.* 40(3):498 (2002). New Zealand, Buller, Murchison, Matakitaki Rd, *R.E. Beever 1687*, 11 Aug. 1998; Holotype: PDD 69224.

Russula phymatodispora (G.W.Beaton, Pegler & T.W.K.Young) T.Lebel **comb. nov.**

MB 820041

Cystangium phymatodisporum G.W.Beaton, Pegler & T.W.K.Young, *Kew Bull.* 39: 672 (1984). Dry Ck, Eildon State Park, Vic., 14 Aug. 1982, *A.C. Beauglehole, K. & G.W.Beaton 50*; Holotype: K(M).

Russula pisiglarea (T.Lebel) T.Lebel **comb. nov.**

MB 820042

Cystangium pisiglareum T.Lebel, *Austral. Syst. Bot.* 16: 383 (2003), as *'pisiglarea'*. near bridge, Dickenson Rd, Pemberton, W.A., 3 May 1983, *N. Malajczuk H337*; Holotype: PERTH; isotype: MEL 2146436.

Russula pterosperma (T.Lebel) T.Lebel **comb. nov.**

MB 820043

Gymnomyces pterospermus T.Lebel, *Austral. Syst. Bot.* 16: 416 (2003). Blanketleaf picnic ground, Erskine R., Vic., 11 Jul. 1993, *T. Lebel s.n. (J.M. Trappe 14223)*; Holotype: MEL 2145853.

Russula rodwayi (Massee) T.Lebel **comb. nov.**

MB 820044

Secotium rodwayi Massee, *Bull. Misc. Inform. Kew* 1901: 158, fig. 68 (1901)

Elasmomyces rodwayi (Massee) Zeller, *Mycologia* 40: 642 (1948)

Cystangium rodwayi (Massee) A.H.Sm., *Mycologia* 54: 633 (1962). Tas., *L. Rodway 571*; Holotype: K(M) 190884.

Russula seminuda (Massee & Rodway) T.Lebel **comb. nov.**

MB 820045

Gymnomyces seminudus Massee & Rodway, in Massee, *Bull. Misc. Inform. Kew* 138: 125 (1898)

Arcangeliella seminuda (Massee & Rodway) Zeller & C.W.Dodge, *Ann. Missouri Bot. Gard.* 23: 617 (1937)

Octaviania seminuda (Massee & Rodway) G.Cunn., *Trans. & Proc. Roy. Soc. New Zealand* 67: 408, pl. 33, fig. 19 (1938)

Cystangium seminudum (Massee & Rodway) T.Lebel & Castellano, *Mycologia* 94: 337 (2002). Tas., *L. Rodway 124*; Holotype: HO.

Russula sessilis (Massee & Rodway) T.Lebel **comb. nov.**

MB 820046

Secotium sessile Massee & Rodway, in Rodway, *Pap. & Proc. Roy. Soc. Tasmania* 1911: 31, pl. 3 (1912)

Elasmomyces sessile (Massee & Rodway) Rodway, *Pap. & Proc. Roy. Soc. Tasmania* 1924: 8 (1925)

Cystangium sessile (Massee & Rodway) Singer &

A.H.Sm., *Mem. Torrey Bot. Club* 21: 67 (1960). Cascades, [Hobart], Tas., Jul. 1920, *L. Rodway 647*; Neotype: K(M) 190882 [Rodway 1912]

Russula shultziae (T.Lebel) T.Lebel **comb. nov.**

MB 820047

Cystangium shultziae T.Lebel, *Austral. Syst. Bot.* 16: 385 (2003). The Barry Way, 1.1 km S of sign for Suggan Buggan, Alpine Natl Park, Vic., 18 May 1999, *A.W. Claridge 2098, A. Jumpponen & J.M. Trappe*; Holotype: MEL 2146457; isotype: OSC.

Russula sparsa (T.Lebel) T.Lebel **comb. nov.**

MB 820048

Cystangium sparsum T.Lebel, *Austral. Syst. Bot.* 16: 388 (2003). Eaglehawk Neck, Tas., 18 May 1991, *M. Trappe H5331*; Holotype: HO.

Russula theodoroui (T.Lebel) T.Lebel **comb. nov.**

MB 820049

Cystangium theodoroui T.Lebel, *Austral. Syst. Bot.* 16: 390 (2003). Brisbane S.F., near Fernvale, Qld, 7 May 1992, *M. Castellano H6173*; Holotype: BRI; isotype: MEL 2146439, OSC, PERTH.

Russula trappei (T.Lebel) T.Lebel **comb. nov.**

MB 820050

Cystangium trappei T.Lebel, *Austral. Syst. Bot.* 16: 392 (2003). Sheepstation campground, Border Ranges Natl Park, N.S.W., 5 May 1992, *J.M. Trappe H6072*; Holotype: DAR.

Russula westresii (T.Lebel) T.Lebel **comb. nov.**

MB 820051

Gymnomyces westresii T.Lebel, *Austral. Syst. Bot.* 16: 420 (2003). Big Tree Track, Lemonthyme, Tas., 12 May 1991, *J.M. Trappe H4747*; Holotype: HO; isotype: MEL 2146465, PERTH.

Russula wirrabarensis (Grgur.) T.Lebel **comb. nov.**

MB 820052

Gymnomyces wirrabarensis Grgur., *Larger Fungi S. Australia* 86 (1997). Mt Lofty, S.A., 18 Jul. 1932 [*JB. Cleland*]; Holotype: AD 5843.

Russula xanthocarpa (T.Lebel) T.Lebel **comb. nov.**

MB 820053

Cystangium xanthocarpum T.Lebel, *Austral. Syst. Bot.* 16: 394 (2003). Arthur Hwy, S of Murdana, Tas., 18 May 1991, *R. Robinson H5310*; Holotype: HO.

Nomina nova

This section covers sequestrate taxa for which direct new combinations within *Russula* could not be made as the specific epithets were preoccupied.

Russula aurantirosea T.Lebel **nom. nov.**

MB 820058

Gymnomyces clelandii T.Lebel, *Austral. Syst. Bot.* 16: 404 (2003). Cleland Conservation Park, Mt Lofty summit, S.A., 18 Jun. 1994, *T. Lebel H6852*; Holotype: AD.

The combination *Russula clelandii* cannot be made as it is preoccupied by *R. clelandii* O.K.Mill. & R.N.Hilton, hence the need for a *nomen novum*. The new epithet refers to the pale orange-pink colour (L. *aurantius* = orange; *roseus* = pink) of the pileus and hymenophore.

Russula collubrina T.Lebel **nom. nov.**

MB 820059

Cystangium polychromum Trappe & Claridge, *Australas. Mycol.* 22: 33 (2003). Blue Cow Mtn, Guthega, Mount Kosciuszko Natl Park, N.S.W., 1 Apr. 2000, *J.M. Trappe 25050*; Holotype: MEL 2236362; isotype: DAR, OSC.

Illustrations: J.M. Trappe & A.W. Claridge, loc. cit. 30, figs 4–6; 31, figs 13, 14, as *Cystangium polychromum*

A new *Russula* name is required for this taxon because the name, *R. polychroma* (Singer) Horak, is preoccupied. The new epithet refers to the mottled (L. *collubrinus*) colouring of the pileus like the camouflage colouring of a snake skin.

Russula korystospora T.Lebel **nom. nov.**

MB 821530

Gymnomyces cristatus T. Lebel, *New Zealand J. Bot.* 40(3): 491 (2002). New Zealand, Gisborne, Urewera NP, Huiarau Range, *M. Castellano s.n.*, 25 May 1995, Holotype: PDD 65083.

The epithet *'cristata'* is already in use (Romagnese, *Bull. Mens. Soc. Linn. Lyon* 31(1): 177 (1962). The new epithet refers to the crested spore ornamentation [Gk. *korystos* = crested; *spora* =spore].

Russula leonardii T.Lebel **nom. nov.**

MB 820060

Gymnomyces rodwayi T.Lebel, *Austral. Syst. Bot.* 16: 418 (2003). Speeler Track, Cradle Mountain Natl Park, Tas., 13 May 1991, *M. Castellano H5058*; Holotype: HO; isotype: MEL 2146462, PERTH.

The combination *Russula rodwayi* (Massee) T.Lebel is in the present publication for a different taxon, based on *Secotium rodwayi*. Therefore, *Russula leonardii* is introduced here to further honour Leonard Rodway (1853–1936) who published extensively on the fungi and plants of Tasmania.

Russula olivaceoflava T.Lebel **nom. nov.**

MB 821532

Cystangium flavovirens T.Lebel, *Austral. Syst. Bot.* 16: 377 (2003). Black Charlies Gully, Tas., 2 May 1990, *M. Castellano, J.M. Trappe, N. Malajczuk & M. Amaranthus H1297*; Holotype: HO; isotype: MEL 2146443, OSC, PERTH.

The name *Cystangium flavovirens* is already in use (Bommer & Rousseau, *Bull. Soc. R. Bot. Belg.* 26(no. 1): 58 (repr.) (1887)). The new epithet refers to the olivaceous yellow tones of the pileus [L. *olivaceus* = olive green; *flavus*= pale yellow].

Russula osphranticarpa T.Lebel **nom. nov.**

MB 820061

Octaviania redolens G.Cunn., *New Zealand J. Agric. Res., A* 23B: 172 (1942). New Zealand, Auckland, Mt Te Aroha (350 ft), May 1940, *G. Cunningham 10141*; Holotype: PDD 10141.

Gymnomyces redolens (G.Cunn.) Pfister, *Occ. Pap. Farlow Herb. Cryptog. Bot.* 9: 43 (1976)

Stephanospora redolens (G.Cunn.) E.Horak, *Pl. Syst. Evol.* 131: 163 (1979). Nom. inval., full citation of basionym missing.

Martellia redolens (G.Cunn.) G.W.Beaton, Pegler & T.W.K.Young, *Kew Bull.* 39(4): 682 (1984).

The name *Russula redolens* is already in use (Burlingham, *Mycologia* 13(3): 133, 1921), so a new name for this taxon is required. The new epithet refers to the pleasant odour of the fruit bodies [Gk. *osphrantos* = smellable; *carpus* = fruitbody].

Russula paneeroides T.Lebel **nom. nov.**

MB 821533

Gymnomyces pallidus Massee & Rodway, in Massee, *Bull. Misc. Inform. Kew* 1898: 125 (1898). West Coast, Tas., Jun. 1896, *L.Rodway 299*; Holotype: K(M) 190872.

Octaviania pallida (Massee & Rodway) G.Cunn., *Proc. Linn. Soc. New South Wales* 60: 119 (1935)

The name *Russula pallida* is already in use (Karsten, *Hedwigia* 35(1): 43 (1896)), so a new name for this taxon is required. The new epithet refers to the pale colour and texture of the fruit bodies [*paneer*= cheesy curd-like whey; *-oides* = resembling].

Russula spinispora T.Lebel **nom. nov.**

MB 821534

Gymnomyces fuscus T.Lebel, *New Zealand J. Bot.* 40(3): 495 (2002). New Zealand, North Island, Auckland, West Auckland, Goldie Bush, Mokoroa Falls track, *R.E. Beever 1306*, 1 Jan. 1992; Holotype: PDD 61990

The epithet *'fusca'* is preoccupied in *Russula* (Quélet, *Compt. Rend. Assoc. Franç. Avancem. Sci.* 15(2): 486 (1887) [1886]). The new epithet refers to the spiny spore ornamentation [L. *spina* = spine; *spora* = spore].

Validations

Validations of previously published names that were invalid for various reasons.

RUSSULA

Russula luteirosea (Bougher) T.Lebel, **comb. nov.**

MB 822048

☒ *Macowanites luteiroseus* Bougher, *Mycotaxon* 63: 38 (1997). Western Australia, Walpole-Nornalup National Park, Nunn Rd, *K. Syme*; Holotype: PERTH 04259661. MB 437543.

"Russula luteirosea" T.Lebel, in Lebel & Tonkin, *Austral. Syst. Bot.* 20(4): 378 (2007), nom. inval. (direct reference to basionym omitted; page spread '37-48' given). MB 580675.

Russula rubrolutea (T.Lebel) T.Lebel, **comb. nov.**

MB 822049

☒ *Macowanites rubroluteus* T.Lebel, *New Zealand J. Bot.* 40(3): 505 (2002). New Zealand, South Island, Nelson, Glenhope-Tapawerea Rd, *D. Russell s.n., J.M. Trappe 12610*, 25 Sept. 1992; Holotype: PDD 83697. MB 484028

"Russula rubrolutea" T.Lebel, in Lebel & Tonkin, *Austral. Syst. Bot.* 20(4): 378 (2007), nom. inval. (direct reference to basionym not given; page number omitted). MB 531353

Dating of competing names

Octaviania lamingtonensis (J.W.Cribb) T.Lebel & Castellano, *Mycologia* 94: 352 (2002). Published 15 March 2002.

This same combination also made by Trappe, Lebel & Castellano, *Mycotaxon* 81: 203 (2002). Published 2 April 2002.

Epithet corrections

Agaricus colpeteorum T.Lebel

Published as *A. colpetei* T.Lebel, *Mycological Progress* 12 (4): 702 (2012). MB#801763. As the epithet refers to two people, it should be plural genitive.

Mycobank numbering issue

Two names in *Stephanospora* were validly published by Lebel et al. (2015) but due to an error in issuing of identifiers by the repository Mycobank, new identifiers have been issued as follows:

Stephanospora kanuka T.Lebel & Castellano, *Fungal Diversity* 119: 216 (2015)

MB 815981

Stephanospora hystrispora T.Lebel & Castellano, *Fungal Diversity* 119: 213 (2015)

MB 815980

Mycobank (accessed 13 Dec 2016) states: "WARNING: due to a databasing error, the same Mycobank number (MB809846) was wrongly attributed to *Stephanospora hystrispora* (MB915980), *Stephanospora kanuka* (MB915981) and *Phyllosticta carochlae* (MB915982). All the three names are therefore validly published but a new MB number is attributed to them. Mycobank takes full responsibility for this issue."

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Muelleria

36: 15–21

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ROYAL
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Nicotiana maritima (not) in Victoria

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Introduction

Accounts of the Victorian flora since the publication of the predominantly South Australian *Nicotiana maritima* H.-M.Wheeler (1935) have included the species as a rare occurrence in the state. Willis (1973) noted it was known from: 'two old collections from Port Phillip region and, the last made at Studley Park, Kew in Jan. 1883. No further occurrences have been noted this century'. Beauglehole (1983) repeated the localities cited by Willis. In the *Flora of Victoria* (Jeanes 1999), it was recorded as being 'known from only a few old collections from the Wimmera and near Melbourne and possibly now extinct in the State'.

Wheeler (1935) cited a single MEL specimen of *N. maritima*, collected by Mueller, from Victoria, 'Port Philippi'. The specimen (MEL 1605904) is mixed, with two Mueller labels, both determined by him as the more widespread *Nicotiana suaveolens* Lehm., one from 'N. Holl. Austr.' (i.e. South Australia), and the other the 'Port Phillipi' locality. Wheeler's original determination as *N. maritima* has a qualification: 'referring to attached sprig bearing both leaves and flowers'. I have no doubt that Wheeler's determination is correct for the sprig to which she refers. The remaining material appears to be a single leaf of *N. maritima* and a leaf and stem fragments appearing to be *N. suaveolens*. There is no connection made (by Mueller at least) between the mounted items on the sheet and the labels. It appears that Wheeler has taken the more specific locality, i.e. 'Port Phillipi', to place the specimen(s), but, given that she regarded this as the sole Victorian occurrence, the more parsimonious conclusion would be that the genuine *N. maritima* fragment belongs with the 'N. Holl. Austr.' label, and the remainder (i.e. *N. suaveolens*) from Port Phillip. Wheeler may not have realised the important distinction between 'N. Holl. Austr.'

Abstract

Examination of herbarium specimens, the literature and nursery trials of seed-grown Coastal Tobacco, *Nicotiana maritima* H.-M.Wheeler, and Native Tobacco, *N. suaveolens* Lehm., were undertaken to test the notion that *N. maritima* was a *bona fide* member of the Victorian flora. All evidence suggests that it is not and has probably never been a wild-occurring species in this state. A summary of the evidence from morphological evidence and reinterpretation of label information is provided and critical characters are reassessed and illustrated.

Keywords: Native Tobacco, misidentification, redetermination, Solanaceae, Nicotianeae, Victorian flora

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Figure 1. Corolla tube and limb. **a., b.** *Nicotiana maritima, N. Walsh 8477*, MEL; **c., d.** *N.* 'Cape Schanck', *N.G. Walsh 8476*, MEL.

and 'Port Phillipi', perhaps imagining the former to be a generalised locality that included the latter. *Nicotiana suaveolens* is still known from near Melbourne (e.g. Studley Park, Kew), probably within Mueller's early concept of 'Port Phillipi'. A subsequent determination on MEL 1605904 by P. Horton in 1979 notes 'Poor specimen, maybe *Nicotiana maritima* Wheeler'.

Other specimens at MEL have perpetuated the notion that *N. maritima* is or has been a Victorian species. Another early collection (MEL 1605905) also has two labels: 'Studley Park 1883' and 'Shire of Dimboola 1892', both with F.M. Reader as the collector. The Dimboola specimen has subsequently been annotated 'label does not belong with this specimen' without explanation. The sheet has a 1934 determination by Wheeler, followed by '?'. Horton has appeared to have uncritically followed Wheeler's suggestion (but without a query) and noted 'Almost glabrous nature suggests *N. suaveolens*, but upper stems and leaves of *N. maritima* occasionally are glabrous or nearly so'. My opinion is that this specimen is *N. suaveolens* on morphological grounds (see 'Identification notes' below) and the Studley Park locality accords with more recent collections from the same area. The distinction between *N. maritima* and *N. suaveolens* in recent accounts (Symon 1982; Jeanes 1999) focuses on the different indumenta of the species, e.g. 'Stems and leaves pubescent all over' (*N. maritima*) versus 'Stems and leaves glabrous, glabrescent, or pubescent near base only' (*N. suaveolens*) (Symon 1982). Consequently, applying these criteria, plants at the hairy end of the spectrum for *N. suaveolens* are likely to be misdetermined for *N. maritima*.

A third candidate for an early Victorian occurrence of *N. maritima* exists which is reliably determined and carries an old, but undated and unattributed label stating 'growing near Mitcham'. This has been interpreted as being of Victorian origin and was originally included on the MEL specimen database (MELISR) as such. It is however much more likely that the Mitcham referred to is the town at the foot of the Adelaide Hills in South Australia, near to where several specimens of the species are held in the Adelaide herbarium (AD) and visible on Australia's Virtual Herbarium (AVH 2017).

More recent collections have maintained the belief that *N. maritima* is a member of the Victorian flora, and have raised some conservation concerns about the species in the state. Again, Studley Park features: a collection (*R.W. Robinson s.n.*, March 1987, MEL 1553801) that includes the note (as *N. maritima*) 'First relocated by Willis in 1980 ...' (although Willis's collection is now, and was regarded by him then, as *N. suaveolens*). The Robinson specimen was redetermined by David Symon (author of the *Flora of Australia* account, Symon 1982) as *N. suaveolens* in 1987. A 1989 collection from Gunnamatta on the Mornington Peninsula, tentatively identified as *N. maritima* (*Westaway 604*, 24 Jan. 1989, MEL 694538) was redetermined by Jeff Jeanes (author of the *Flora of Victoria* account, Jeanes 1999) as *N. suaveolens* in 1996. Both these specimens are of plants that are moderately pubescent in some parts, but considerably less pubescent than any reliably determined examples of *N. maritima* at MEL.

Despite these redeterminations, some authorities have sometimes continued to regard the occurrences in the Gunnamatta-Cape Schanck area as important, disjunct populations of *N. maritima*.

Materials and methods

In 2015, acting under the auspices of the Victorian Conservation Seedbank (at the Royal Botanic Gardens Victoria), I was commissioned to make a conservation seed collection of what local authorities were regarding as *Nicotiana maritima* from near Cape Schanck, essentially the same population as *Westaway 604* noted above. I took the opportunity to reassess the identification of plants in this population by growing a cohort of seedlings and comparing them to authentic *N. maritima* grown under the same conditions.

Seed of genuine *N. maritima* of South Australian origin was sourced from the South Australian Seedbank, from plants collected on the Fleurieu Peninsula (*M.K. Jones 140 & D. Duval*, AD 187318).

Fifteen plants of both species were grown adjacently in open, uniform conditions at the Melbourne Gardens nursery (Royal Botanic Gardens Victoria), and their development compared to maturity. Both seedlots produced uniform progeny. At all stages, plants of *N. maritima* were distinctly more pubescent than those of *N. suaveolens*. Interestingly, although the lower stems of Cape Schanck plants were noticeably pubescent when collected in the field, nursery-grown progeny were only weakly pubescent, suggesting that density

Table 1. Morphological observations of *Nicotiana maritima* and *Nicotiana* 'Cape Schanck'

Character	*Nicotiana maritima*	*Nicotiana 'Cape Schanck'*
Habit (Fig. 2)	Loosely rosetted (early growth); cauline leaves abundant, more or less regularly arranged along stems and extending into inflorescence	Strongly rosetted (early growth); cauline leaves few, or restricted to near base of plant and often clustered, not extending into inflorescences
Indumentum (vegetative surfaces, Figs 3,4)	Villous to pubescent throughout; leaf abaxial surface with 5–c. 20 hairs per sq. mm	Glabrous, glabrescent, sometimes pubescent, then usually only on lower stem and abaxial surface of leaves; leaf abaxial surface with 0–2 hairs per sq. mm
Leaf shape (Fig. 5)	Spathulate or ovate to broad-ovate and tapered abruptly to a distinct winged, petiole-like base, up to as long as the expanded upper part, usually shortly decurrent along stem	Ovate, tapered more or less evenly to base, sessile or with a short, unwinged petiole, not or barely decurrent along stem
Leaf margin (Fig. 5)	Strongly and more or less evenly undulate	Plane or weakly and irregularly undulate
Leaf lamina 3D (Fig. 5)	Lamina usually 'puckered'	Lamina plane
Calyx length	(6–)9–12(–16) mm	(8–)9–14(–26) mm
Corolla length	(13–)15–19(–30) mm	(17–)22–35(–55) mm
Corolla/calyx ratio	1.5–2	2.5–3.5
Corolla tube shape (Fig. 1)	Cylindric, shortly expanded then contracted just below limb	Clyindric to elongate-obconical, neither expanded nor contracted below limb
Corolla colour (Fig. 1)	Pale yellowish, tinged purple	Cream to white, tinged green
Limb diameter	(7.5–)11–20(–24) mm	(14–)22–28(–44) mm
Limb dissection (Fig. 5)	Lobes distinctly notched apically, free for c. half diameter of limb	Lobes barely notched apically, free for distinctly less than half diameter of limb

of indumentum is at least partly under environmental control in this population.

While the density of indumentum is persuasive, the indumentum type of both species is essentially the same: a mixture of long, simple, multicellular, eglandular hairs and short, multicellular, gland-tipped hairs, some of which are larger and have the lower cells distinctly inflated. The latter type, with inflated basal cells, tend to be restricted to the pedicels and calyces of both species. The various hair types are well illustrated in Marks et al. (2011), figs 7, 8.

As mentioned above, current keys including *N. maritima* and *N. suaveolens* focus on differences of indumentum. Having plants *in vivo* at all stages of development enabled close comparison of features and offered the opportunity to establish more critical bases for their distinction.

Results

Measurements and observations from the living plants are given in Table 1. Bracketed values for calyx and corolla length and limb diameter were the extremes for those features as reported in accounts of the genus in Australia (Wheeler 1935; Horton 1981; Symon 1982).

Vouchers for each seedlot are: *Nicotiana maritima — N.G. Walsh 8477* (MEL 2404759, MEL 2404760, MEL 2404761); *N. 'Cape Schanck' — N.G. Walsh 8476* (MEL 2404757, MEL 2404758).

In re-examining the various published accounts (Wheeler 1935; Horton 1981; Symon 1982; Jeanes 1999) in light of these observations, it is clear that the Cape Schanck plants conform to *N. suaveolens*, as redeterminations at MEL had suggested. Further, the detailed account of Wheeler (1935) in particular, was shown to be very perceptive, describing all of the differences noted in Table 1, although not drawing particular attention to them as discriminatory features. Subsequent accounts were less detailed. Wheeler's key to species separated *N. maritima* from *N. suaveolens* by the shorter corolla and the smaller corolla-calyx ratio with no mention of indumentum, in contrast to the more recent treatments. The reliance on indumentum in these three recent treatments seems to be cause for the confusion around the identification of the Studley Park and Cape Schanck populations.

To the key characters employed by Wheeler, I would recommend adding, as a decisive feature, the shape of the corolla tube just below the limb (Fig. 1) and arrangement of the corolla lobes of the limb (Fig. 1).

Figure 2. Habits of plants at first flowering. *N. maritima* at left and *N.* 'Cape Schanck'at right. Cultivated, RBGV Melbourne nursery.

Figure 3. Leaf bases and lower stem indumentum; *N. maritima*. Note dense indumentum, sub-auriculate leaf bases and winged petioles. Cultivated, RBGV Melbourne nursery.

Figure 4. Leaf bases and lower stem indumentum; *N.* 'Cape Schanck'. Note sparse indumentum, tapered leaf bases and naked petioles. Cultivated, RBGV Melbourne nursery.

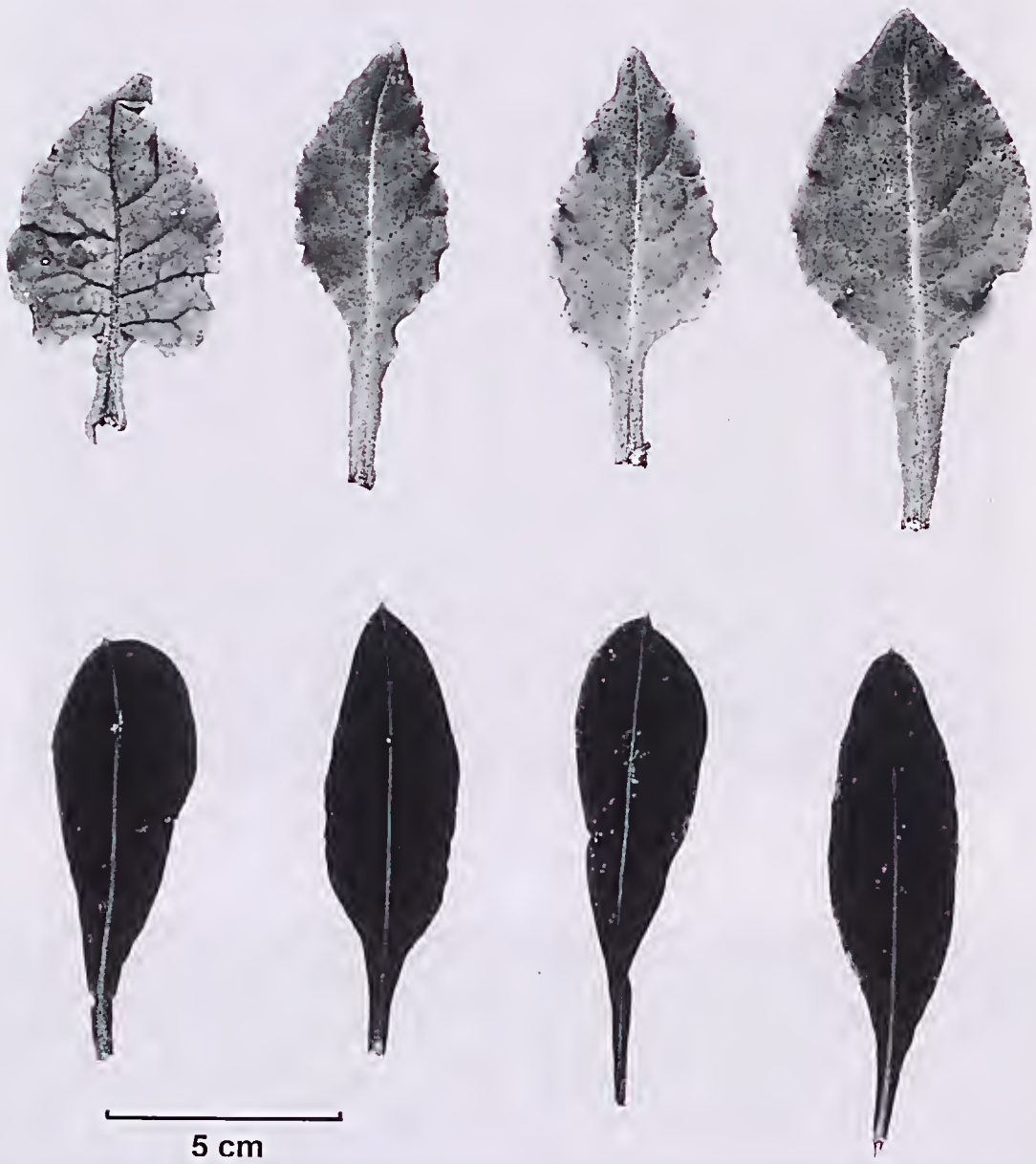

Figure 5. Silhouettes of leaves of *N. maritima* (above) and *N.* 'Cape Schanck' (below). The 'puckered' nature of the leaves of *N. maritima* is evident. From plants cultivated at RBGV Melbourne nursery.

The latter feature is reinforced in the treatment by Marks et al. (2011, fig. 4d). While the corolla features may be difficult to observe on herbarium specimens, they are usually perceptible, and very obvious in living specimens, although young buds of *N. suaveolens* may give the impression of a slight contraction below the limb – this is an artifact of pressing and drying that I have replicated with flowers from the nursery-grown plants. The ring of anthers at this stage is just below the limb (yet to expand) and causes a slight bulge when pressed. Flowers of *N. suaveolens* pressed at anthesis do not show this feature, while those of *N. maritima* clearly do. The different habits and leaf shapes are also strong supporting characters if/when floral characters are not available (Figs 2–5). As in previous studies, I could not find convincing and consistent differences in seed shape, size or ornamentation – features that are often diagnostic amongst Australian species.

Conclusion

Despite various references to *Nicotiana maritima* being (or having been) a member of the Victorian flora, I believe each piece of evidence for this is to be mistaken, either through mixing or misinterpretation of herbarium specimen labels, or through misidentification as a result of contemporary keys to identification relying on relatively weak characters for discerning *N. maritima* from its near relatives.

Unlike recently published keys and accounts, future keys that include both species should focus more on features of the corolla and foliage than on the density of indumentum.

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ROYAL BOTANIC GARDENS VICTORIA

A passion for plants: The botanical contribution of collector P.J. Murphy

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Abstract

'Collector: Murphy, P.J.' listed on the online Australasian Virtual Herbarium, collected plant specimens from the early 1980s to 2006. Fifteen specimens were sent to the National Herbarium of Victoria during her lifetime, and the remaining collection of 1123 specimens was donated to the Herbarium in 2007. Who was P.J. Murphy, why did she collect, and what can be discovered by examining her collection of specimens? Much of the information in this article is derived from the minutes of the Field Naturalists' Club of Ballarat (FNCB) and from interviews with her husband, Bill Murphy, and members of FNCB.

Keywords: plant collecting, Ballarat, field naturalists, gender history

Introduction

The contribution of women to Australian botany has not yet been fully explored. Pat Murphy's contribution was significant both in her local area and through the 1138 specimens she collected that are now held at the National Herbarium, Royal Botanic Gardens Victoria (MEL). Pat's story extends the history of collectors and collecting beyond the colonial era into the twentieth and twenty-first centuries, a period as yet only lightly touched on in the history of botany. One advantage of examining a more recent collector is the availability of people who knew Pat and whose memories of her can be accessed through oral history interviews. The Field Naturalists' Club of Ballarat (FNCB) provided the context for Pat's learning about botany and her involvement in collecting (Fig. 1a,b). I was able to

Figure 1 a. Pat Murphy c1999; **b.** Pat Murphy on a Field Naturalists' Club of Ballarat excursion 1995

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interview members of the FNCB as well as Pat's husband Bill Murphy. This gave the research a very personal aspect as well as extending it to an understanding of the role of the field naturalists' club in encouraging and supporting field work and specimen collection. I was also invited to participate in FNCB excursions to locations where Pat collected many of her specimens. The opportunity to walk in the bush and re-find some of the specimens Pat discovered was a uniquely moving experience.

Pat came to the study of botany through the Field Naturalists' Club of Ballarat, where she met Stella Bedggood who had studied the local flora for many years. Field naturalists learn through a combination of field work and reading, and through discussing and sharing knowledge with each other, as well as through communication with professional botanists. Their knowledge is passed on through mentoring. As Helen Cohn wrote of the FNCV in the nineteenth century: 'If you wanted to connect with a community of botanists in Victoria ... It was the Field Naturalists' Club of Victoria that provided this sense of community' (Cohn 2005: 284). This was still true of the Field Naturalists' Club of Ballarat in the twentieth century, where the sense of being part of a community of people interested in understanding the local flora and fauna was a major part of learning. Well-known archaeological artist Peter Trusler has written of his time as a teenage member of the Field Naturalists' Club of Ballarat as 'a learning experience with unbridled information that came not via curriculum, but via personality. Knowledge came passionately, imparted by unusual people from all walks of life' (Trusler, Vickers-Rich & Rich 2010: 9).

Field naturalists' clubs have been an important source of botanical discovery and specimen collection in Australia since the late nineteenth century. This has resulted in long-term links with herbaria and museums. Gary Presland discusses these links in his history of the Field Naturalists' Club of Victoria, which w as established by a group of staff from the Royal Botanic Gardens Victoria and for many years met at the Gardens. His observation that 'Since its beginnings, the Club has significantly augmented the collections of the herbarium, through the field collecting activities of its members' (Presland 2016: 54) can be applied to other field naturalists' clubs throughout Victoria, including Ballarat.

Ferdinand von Mueller was an active member of the Field Naturalists' Club of Victoria and had a wide network of collectors, both men and women, throughout Australia. Sara Maroske writes that the collectors 'helped him to accumulate a significant Australian herbarium in Melbourne' and assisted him in his extensive contribution to George Bentham's *Flora Australiensis* published between 1863 and 1878 (Maroske 2014: 72). He actively encouraged the formation of field naturalists' clubs. When Thomas Hart was appointed as science lecturer at the Ballarat School of Mines in 1896, soon after the first Ballarat Field Club and Science Society established at the School in 1882 had ceased to exist, Ferdinand von Mueller wrote to him encouraging him to start a field naturalists' club: ' Let me advise you, to start at once a Field-Naturalists Club in your important and prosperous town ... You will then have locally at once a number of Amateur-Collectors, both Ladies and Gentlemen, and an immense impetus will be given to local research ... every town throughout Australia ought to have some such Association...' (Home et al: 2006: 746-8). While Thomas Hart did not act on the suggestion, the Field Club and Science Society was re-formed in Ballarat in 1915, holding successful annual wildflower shows until it folded in 1918 due to 'the occupation of most members in War Work' (FNCB Minutes 9 April 1918). it was revived again in 1952 as the Field Naturalists' Club of Ballarat and continues as an active organisation in 2018.[1]

In the twentieth century, the role of connecting MEL with field naturalists was taken up by Jim Willis who actively corresponded with people throughout Victoria during his 34 years at MEL. Helen Aston describes him as 'an unassuming man of gentle and compassionate disposition' who 'gave his time and knowledge and encouragement unstintingly to those who sought his help, extending courtesy and friendship to professional and amateur ... He would identify piles of specimens for enquirers but no one was ever made to feel that they were intruding on his time.' (Aston1996: 2 & 3) This was undoubtedly true, and Jim appreciated that field naturalists sent him specimens of plants that were unusual, perhaps previously undescribed, or extending

1 I have taken my cue from the Club's 25th anniversary history of the present club, published in 1977, which sees its origins in the 1882 field club (FNCB 1977:13-24).

the range, or hybrids, or rare in the location where they were found. While they sought confirmation from Jim, their aim was to add to the body of knowledge held at the Herbarium, as in most cases they had already identified the plant. The connection of field naturalists with the Herbarium created an extensive network of field workers beyond the small number of paid botanists. David Elliston Allen describes the qualities of a first-class naturalist as 'that instinctive love of order, system and detailed record; patience; unremitting care...' (Allen 1976: 155). It is these qualities that make field naturalists ideal botanical researchers and collectors. Several members of the Field Naturalists' Club of Ballarat contributed specimens, artworks and photos to the Herbarium in the twentieth century via Jim Willis – not a large number of specimens, but sent because they were significant 'finds' (see Appendix 1 and 2). In the 21st century, MEL continues to maintain an informal network of collectors, who may be employees of the State government department (currently DELWP) or members of field naturalists' clubs or individuals.[2] Neville Walsh, who has been a MEL botanist since 1983, writes that the specimens they send in 'are often really interesting records for us' and that sometimes the enquiry is initiated by MEL botanists who ask collectors to look for particular species (Walsh 2017).

Women played a role in field naturalists' clubs almost from the beginning. The FNCV admitted Henrietta Dobson, wife of the Hon F.S. Dobson, in 1881 (Houghton 2005: 290) and the Ballarat Field and Science Society records Miss Wooster, daughter of Mr W.H. Wooster, as a member in the 1880s. In London, the Zoological and Botanical Societies had admitted women on the same terms as men from their founding, unlike the Royal Society and Geological Society (Allen 1976: 152). Sheila Houghton, writing of the women who joined the FNCV, writes of three categories of women: 'those for whom natural history was a passion, whose work in their chosen field led them to become well-known beyond a Club which provided them with interaction with other naturalists'; those 'for whom the Club provided a focus for their interests'; and the vast majority 'for whom natural history was a hobby' (Houghton 2005: 304). Pat Murphy and her mentor Stella Bedggood belong firmly in the first category – those for whom natural history was a passion.

Life in the 1950s and 1960s had become easier for women, but was still very different from life in the twenty-first century. When Helen Aston qualified as a botanist and began working at MEL in 1957 female botanists were not allowed to go out on botanical field excursions with male botanists. A few years later Helen applied for a job at the Fisheries and Wildlife Department but was told that although she had all the qualifications and experience they wanted, 'I can't send you out in the field with men' (Aston 2017). But field naturalists' clubs had always included women on field excursions and camps – single, widowed and divorced women, married women whose husbands were not naturalists, as well as the wives of naturalists. FNCB member Margaret Rotheram recalls that she was fortunate to go with Ballarat field naturalists to remote places such as the Dog Fence where she could not have gone alone (Rotheram 2016).

In *Botanical Companions*, Frieda Knobloch examines the relationship of professional botanists Ruth and Aven Nelson in Wyoming. She writes '... field work brought work and play together, companionship, knowledge of the living world, through and beyond botany' (Knobloch 2005: 96-8). She suggests that field work has dimensions beyond the science of botany, especially when shared with a companion. In the case of Pat Murphy, the idea of botanical companionship can be explored in relation to her friend and mentor, Stella Bedggood, and her husband Bill Murphy.

Sara Maroske suggests that 'a botanical history that recovers the contributions of girls and women ... will require considering aspects of their lived experience previously excluded as irrelevant because they were deemed ornamental or domestic' (Maroske 2014: 89). Caroline Jordan examines the changing evaluation of colonial women artists who were once dismissed as 'amateurs' (Jordan 2005: 4). Pat Murphy is not a long-forgotten or ignored colonial collector, but it is important to recognise her roles as wife and mother and the way those intersected with her interest in botany. Pat's study of plants developed into an extensive knowledge and resulted in a collection of beautifully presented specimens. Over nearly 40 years, she came to

2 It would be interesting to find out how many collectors in the Herbarium's history have been members of field naturalists' clubs.

know the bushland of her local area, developing what Meredith Fletcher refers to in her biography of Jean Galbraith as 'environmental memory' based on years of botanical observations (Fletcher 2014: 184). Pat's contribution to botany can be understood both in terms of her extensive botanical collection and in terms of the lived experience that enabled its creation.

A botanical and domestic life

Patricia Joan Murphy, née Perkins, was born on 13 May 1930. Her father was a primary school headmaster, Arthur Frederick Perkins, who was educated at Melbourne High School and then Melbourne University and had an interest in natural history though he was not a member of a naturalists' group. Bill Murphy recalls that if a 'tarantula' came into the house, Pat's father would lean against the wall so it would climb onto his shoulder and on his arm, then he would take it outside (Murphy, Feb 2017). Pat was the eldest of five children, and the family lived in the schoolhouse at Devon Meadows on the Mornington Peninsula. What is now the RBGV Australian Garden at Cranbourne was then part of the bushland near their home (Murphy, May 2016). Pat's mother, Mildred, was born in Dorset, England and came to Australia with her parents when she was a child (Murphy, April 2017).

Pat belonged to a generation born between the wars, when many intelligent women were unable to access higher levels of education and the majority of married women with children didn't work outside the home. Pat attended Dandenong High School, then obtained her Leaving Certificate by correspondence. Her brother Ernest studied science at Melbourne University gaining his BSc and Diploma of Education, but at that time tertiary education was not seen as a priority for girls. Instead, Pat became a student teacher and was offered a position in Gippsland. However, it was at that point that she met Bill Murphy while playing tennis and they were married on 11 November 1950 at Cranbourne Anglican Church. When Pat's father became headmaster of a school in Ballarat not long afterwards, Bill and Pat decided to move there as well. Their five children were born in Ballarat (Fig. 2).

Pat was always interested in nature, but she began recording plant observations and collecting specimens after she and her husband Bill joined the Field Naturalists'

Figure 2. Pat Murphy and family **a.** c1959; **b.** c1966

Club of Ballarat in 1968. Pat had met Stella Bedggood (Secretary of the FNCB from 1958 to 1970 and Treasurer from 1971 to 1974) who invited her to come to a field naturalists' club meeting in Ballarat. The guest speaker was Jim Willis, Assistant Government Botanist at MEL. Pat and Bill went to the meeting and were enthralled. Bill recalls that Jim Willis was 'an excellent speaker' and 'such a friendly person' (Murphy, Nov. 2015). Pat and Bill joined the Club and Pat later became Secretary of the FNCB for two years in the 1990s and a committee member until 2001. Bill was President for three years in the 1970s and Vice-President in 1985.

Stella saw that Pat was really interested in plants and, in the way of field naturalists through the generations, became her mentor. Pat was 38 and Stella 52. Stella had been studying the local flora and fauna since she joined the FNCB in the early 1950s. Like Pat's mother, Stella was born in England but came to Australia with her parents and grew up in Ballarat. Her husband, Edwin Bedggood ("Ted"), was a woodcutter and wood merchant from a

Figure 3. Edwin, Stella and Ted Bedggood

family of local wood merchants, at a time when many homes in Ballarat used firewood for heat and cooking, and businesses such as Ballarat Brewery burned wood to create steam. Stella often accompanied Ted to Enfield Forest, exploring while he worked (Pym 2016; FNCB 1997). Her love of the local bushland led her to become an active conservationist, and with the support of her husband she negotiated with local forest officers, politicians and others as FNCB Secretary to have specific areas set aside as reserves for flora and fauna (Fig. 3).

Stella's botanical knowledge was highly regarded well beyond Ballarat. She corresponded with Jim Willis, often enclosing specimens of plants she had found that were not on his existing lists. He replied from his home in Brighton as well as from the Herbarium. In 1965 Jim wrote to Stella:

> *Thanks far drawing my attentian ta the accurrence af Thelymitra antennifera & T. ixioides at the Mount [Beckworth]. I knew nathing af these accurrences, but have now added the names af bath species to my awn census far the Maunt... Despite an indifferent seasan the Victarian Field Nats fram Melbaurne seem ta have had a marvellaus time at the excursian an Oct. 17th, thanks ta your excellent guidance.*

By 1976, the formality of 'Dear Mrs Bedggood' had changed to 'Dear Stella', and the sign off from 'Yours sincerely' to 'Aye, Jim Willis', and the tone was less formal:

> *The enclosures you sent are all quite exciting. Leucapogon glacialis is a splendid find far Enfield, and an intermediate statian far this unusual species between the Brisbane Ranges and its chief hame in the Grampians – cangratulatians! Calytrix tetragana and Pimelea curviflora are "newies" taa far Beckwarth and I wander hawever we all missed finding the Calytrix befare now...*[3]

Stella and Pat attended FNCB excursions with their husbands and children, and later led excursions. Field naturalists' excursions combine discovery and learning with companionship with like-minded people who are interested in finding out about Australia's natural history. Some members develop expertise in specific subjects, while others are happy to learn a little bit about everything. In the 1960s, the club's fungus expert was Mrs Florence Chuk (née Egerton), who recalls arguments between her mother and her grandfather about her education. Her mother bought her botany books and succeeded in having Florence and her sister attend high school. After the war Florence became a maths teacher. She later attended Melbourne Teachers' College and much later completed a Bachelor's degree in Ballarat (Chuk 2016).

The social aspect of field naturalists' excursions complements the field work. Bill Murphy recalls '...the excursions – when we first joined, there were good crowds. We'd get home without tea about 8 o'clock in the evening. We'd take a table with us – or Stella would as Ted had a big car. And they'd bring out the table and we'd have a show and tell at afternoon tea time. Everybody took a plate and they shared a nice sponge or whatever' (Murphy 17 Feb 2017). While the social interactions of people getting to know each other well through field excursions over many years is certainly part of field naturalists' experience, it in no way lessens the seriousness of the field work, and I would argue, enhances it through discussion and shared learning. Less experienced members could show their finds to the group and have them identified, usually with some additional interesting information. Mary White, Headmistress of Ballarat Girls School, recalls 'The naturalists were a very friendly group; the most knowledgeable and senior members were always ready to explain things to the youngest and rawest recruit' (FNCB 1977: 45).

3 Letters in possession of descendants of Stella Bedggood.

Figure 4. Specimen of *Grevillea bedggoodiana* collected by Bon Strange, 17.10.1962 (MEL 98978). Label written by Jim Willis

Figure 5 a. Mrs Bon Strange c1950; **b.** *Grevillea bedggoodiana*. Photo by Emily Noble

In addition to FNCB excursions, Pat and Stella often went to Enfield Forest and other areas around Ballarat on weekdays while their children were at school and together they found and identified many plants. They became friends and the time spent together over ten years out exploring the bush was a joy to both of them. Both women kept plant lists and both obtained collecting licences and took specimens of plants. In the way of field naturalists, they occasionally sent carefully labelled specimens to MEL because they were unusual in themselves (e.g. hybrids) or unusual in that particular location. Six of Stella's specimens are held at MEL (see Appendix 1).

It is perhaps a measure of Jim Willis's regard for Stella as a botanist that the Enfield Grevillea (*Grevillea bedggoodiana* J.H. Willis ex McGill.), a species endemic to Enfield Forest, was named after her by Don McGillivray on Jim's suggestion. FNCB Minutes (22 October 1962) report that a specimen of this creeping grevillea was collected on an FNCB excursion to Enfield on 23 September 1962 and sent to Jim Willis at MEL who 'stated that it is an undescribed species'. The specimen now held at MEL was collected by FNCB member Mrs Bon Strange on 17 October 1962 so was possibly a follow-up to the initial specimen which doesn't appear to be still in existence (Figs. 4, 5). Bon Strange was born Myrtle Lorensene, the eldest daughter of farmers at Scotsburn near Ballarat. She completed her primary education and continued on to Ballarat High School with hopes of becoming a teacher, but 'her hopes were thwarted by the onset of the Depression, as the Government closed teachers' colleges and put off teachers' so she returned to work on the family farm (Beggs-Sunter 1995). MEL holds 15 species collected by Bon Strange between 1961 and 1982 (see Appendix 1).

The Enfield grevillea was not named until 1986, eight years after Stella died, when it was described as a separate species based on a type specimen collected by A.C. (Cliff) Beauglehole and the Field Naturalists' Club of Ballarat in 1978 at Little Hard Hills in Enfield Forest as part of the Land Conservation Council survey (McGillivray 1986:3). Pat Murphy was almost certainly involved in the collection of this specimen as she accompanied Cliff Beauglehole daily and assisted him in finding plants for the LCC survey. The LCC Report on the Ballarat area mentions it as a rare/interesting species 'Grevillea sp., Enfield Grevillea' (LCC 1980: 99). Cliff Beauglehole records it in *The Distribution and Conservation of Vascular Plants in the Ballarat area* in 1983 as '*Grevillea* sp. aff. *aquifolium*', suggesting that it was a species awaiting description, and listed it as a 'rare-interesting-restricted' species (Beauglehole 1983: 71). He includes a record from Wombat State Forest, which was actually *G. repens* F.Muell. ex Meisn. Interestingly, there is a much earlier specimen of the Enfield Grevillea at MEL, collected at Smythesdale in 1879 by C. Collyer, but Neville Walsh notes that at that time it would have been regarded as part of the variable *Grevillea aquifolium* Lindl. Enfield

State Park was originally part of a much larger area known as Smythesdale Forest.

Pat learned plant identification in the field from Stella. Both women used keys for identification. There were no local field guides, and information came from Jim Willis's two-volume *Handbook to Plants in Victoria*, and later the many volumes of *Flora of Australia*. FNCB member Margaret Rotheram recalls Stella sitting on an old tree stump in the bush with a volume of Jim Willis's *Handbook* on her knee, explaining to a group of club members how to key a plant (Rotheram 2016).

In addition to his professional work as a botanist, Jim Willis was an active member of the FNCV. He valued the botanical contributions of field naturalists and was an encouraging and reliable mentor for many, including Stella and Pat. He was also 'a regular contributor' to *The Victorian Naturalist*, and led 'countless expeditions' (Costermans 1995). He shared field naturalists' love of nature and enjoyed being outdoors (Willis 1975: 72). Helen Aston writes 'In the field, Jim's energy and enthusiasm knew no bounds. Time would be forgotten as he searched and collected and he has been known to descend the most rugged of mountains in the dark alone after having failed to notice how rapidly daylight was departing' (Aston 1996: 3). Many field naturalists would relate to that! Jim sometimes joined FNCB excursions (Fig. 6). Members recall that he usually wore a suit, and carried dissecting pins in his lapel, but he was happy to get down on his knees to look at plants, talk to the children and sit on the ground to have a cuppa and chat (Dalman pers comm. 2017). In the 1960s, he sometimes travelled to Ballarat by train and stayed with the Bedggoods. In 1964, Jim Willis provided a plant list and a map plotting significant flora to the Forests Commission to support the FNCB's submission against replacing native flora at Mount Beckworth with pine plantations (FNCB Minutes, 24 March 1964). He continued to take an interest in Mount Beckworth and supported the Club's submission to stop sand mining and have the area set aside as a reserve, writing to Stella on 17 May 1966:

I share your distress at the turn of events at Mt. Beckworth. I have written straight away to Mr Incoll [District Forester] suggesting that alternative sites for sand pits be found; but I fear it is only going over the same ground with him that I did two years ago and that little can be done to check the removal of readily available granite sand. The plant in really imminent danger seems to be Viminaria juncea ("Golden Spray") ... It's the only patch, quite a small one, of Viminaria within 50 miles and it would be a thousand pities to see it bulldozed out of existence there...

Figure 6. Jim Willis on FNCB excursion. Photo by Peter Fry (permission received from Edith Fry)

Allan Sonsee, one of the founding members of the FNCB's reincarnation in 1952, corresponded with Jim Willis for many years, beginning well before the 1950s (Fig. 7). They shared a love of plants, and of the bushland around Creswick.[4] They probably met in the late 1920s when Jim was studying at Creswick School of Forestry and Allan was a young teacher at Smeaton near Creswick. Allan later taught Nature Study at Ballarat Teachers' College from 1947 to 1976. During these years he often took interested students on weekend rambles through the Creswick bush with a copy of Jim Willis' (unpublished) *Synopsis of the Indigenous Plants occurring within a ten-mile radius of Creswick* in hand, looking for plants in the *Synopsis* and trying to find new ones not listed (WILL002). Allan wrote to Jim

4 Jim Willis gave the inaugural Stella Bedggood lecture in Ballarat on 1 June 1979 and titled it 'For the love of Creswick'.

Figure 7. Allan Sonsee. Photo by Peter Fry (reproduced with permission from Edith Fry)

in November 1951 'It is with the students I can do my best work re preservation as they go out to schools all over Victoria'. Allan occasionally sent specimens to Jim for identification or because they were of interest. On one occasion he discovered a small group of Elbow Orchids. He wrote to Jim telling him, but did not send a specimen because 'I think it is unnecessary, and I value it too highly to subject it to the tender care of the G.P.O.' He later found another colony and noted that although it was too late this year, his next task would be 'to try to solve the method of pollination'. In 1953, he sent two orchid specimens with suggested identifications. Jim Willis confirmed that one was *Calochilus campestris* R.Br. and the other was *Prasophyllum odoratum* R.S.Rogers. Allan wrote back that he was 'very excited' to have found *Calochilus campestris* as 'I have long wanted to compare the two species of *Calochilus* listed for Creswick ... It was an even greater thrill to learn I had rediscovered one of your "findings" of 1928. *Prasophyllum odoratum* should now stay discovered ... I am now gradually finding the species listed as rare in your Synopsis...' It is a measure of Allan's regard for Jim that when he proposed to visit Creswick in 1953, Allan hoped he would be at home because 'One day spent with you, is worth a year's botanying alone.' MEL holds eleven specimens collected by Allan between 1942 and 1968 (see Appendix 1). In the 1960s, Allan ran a weekly nature segment for children titled 'Mr Nature Man' on the local television station (BTV 6). On Allan's retirement he was described as 'probably the best known and certainly one of the most highly respected educationists in this Region' (Education Department of Victoria 1976). Like Jim Willis, Allan Sonsee answered numerous letters and queries from teachers, students, school children and field naturalists, 'nor did he spare himself in the process' (Education Department of Victoria 1976).

These gentle, knowledgeable men were early influences on Stella and Pat. However, both women developed their own knowledge of botany and over time came to know the local area in a very 'field natty' way, understanding seasonal changes, identifying plants, knowing their described distribution, soil preferences and plant communities, learning about each species through a combination of observation, discussion and reading. Ballarat is surrounded by different types of geology and soils, with different plant communities, ranging from the southern limits of box-ironbark forests to volcanic plains and lakes, so there was plenty of variety of flora to study.

Photography was also something Stella took up with great interest, learning initially from fellow FNCB member Mr George Howman and soon having considerable success as a member of the Ballarat Camera Club. Some of Stella's photos were selected for the national *Photoflora* exhibitions run by the Society for Growing Australian Plants and many were published in Ballarat's newspaper, *The Courier*. Her photos of fauna are remarkable considering the equipment available at the time (Fig. 8). Pat also took photos, but these were mainly for her own records and identification purposes.

Pat was unassuming although very knowledgeable. FNCB member and DELWP staff member Elspeth Swan recalls that she was usually at the back of the group on club excursions, photographing some plant or other (Fig. 9), but if you paused and asked what she was photographing, she was happy tell you (Swan, pers.comm. 2017). Pat's interest in plants was further increased after she helped Cliff Beauglehole to find and collect specimens as part of the Land Conservation Council survey of the Ballarat region. Prior to Cliff's visit, the Field Naturalists' Club of Ballarat was asked

Figure 8 a. Feathertail Glider; **b.** *Caladenia clavigera* (recently re-found at Enfield by Emily Noble and FNCB). Photographs by Stella Bedggood (permission received from Ian Pym)

Figure 9 (left). Pat Murphy photographing a lizard on an FNCB excursion. Photograph by Peter Fry

Figure 10 (below). Label from Cliff Beauglehole's Ballarat herbarium, acknowledging FNC Ballarat as secondary collector

FIELD NATURALISTS' CLUB OF BALLARAT
Victoria, Australia

Helichrysum scorpioides
Button Everlasting

STATE: VICTORIA STUDY AREA: BALLARAT GRID: J44
LOCALITY: Enfield Forest Park
Little Hard Hills Area
E of Hall Road ± 24 Km SSW of Ballarat P.O.
COLL.: A. C. Beauglehole 60986 and F.N.C. Ballarat 72
DATE: 23·10·1978
DET.: A C·B
NOTES:
DUPL.: MEL

to prepare detailed plant lists. This was done primarily by Stella and Pat. However, Ballarat was one of the last regions to be surveyed, and Stella died in May 1978. Pat continued to make lists, sometimes accompanied by FNCB member Margaret Rotheram. Margaret recalls that lists had to be provided to the LCC in a very short time-frame in the middle of winter, which was challenging as Pat had to identify many plants by a leaf just beginning to appear (Rotheram 2017).

When Cliff visited Ballarat on collecting trips, he stayed with the Murphy family at their home in Dana Street, on one occasion staying for two weeks. Pat accompanied Cliff every day to locations around Ballarat. Bill Murphy would come home from work at lunchtime to put the dinner on, then Pat would return in time to serve it. In the evenings, other members of the FNCB, particularly the Secretary, Helen Burgess, came to the house and helped to sort and press plants until midnight. Margaret Rotheram, a journalist, stayed late after work at *The Courier* each night using the long-carriage typewriter to produce Cliff's landscape-format plant lists with multiple carbon copies. Roger Thomas, a noted Ballarat naturalist and member of FNCB, assisted with information on where plants of interest might be found. The labels on specimens in Cliff's Ballarat herbarium give the Collector as 'A.C. Beauglehole and F.N.C. Ballarat' (Fig. 10). Cliff also acknowledges members of Ballarat Field Naturalists' Club in The Distribution and Conservation of Vascular Plants in the Ballarat Area, including Greg Binns (President), Helen Burgess, Pat Murphy, Margaret Rotheram and Roger Thomas as well as Harry Barclay from Creswick Field Naturalists' Club and Zoe Banfield from Ararat Field Naturalists' Club (Beauglehole 1983: 9). Bill Murphy notes that not all field naturalists' clubs provided this extensive assistance to Cliff in his work, but FNCB put in considerable effort to what they believed was a valuable project (Murphy 4 May 2016). Greg Binns was also President of the Western Victorian Field Naturalists' Association and Margaret Rotheram was Secretary from 1978 to 1980, at a time when the organisation was managing funds for the publication of Cliff's books.

Even a cursory glance at Cliff's herbarium shows how hard they all worked to collect, press, label and record so many specimens in a short time. On 23 October 1978, Cliff and Pat visited Enfield Forest Park, collecting 103 specimens. On 25 October, they visited Enfield again, collecting another 33 specimens. On 26 October they visited Mt Erip, collecting 19 specimens, and on 27 October they returned to Mt Erip, collecting another 12 specimens there and three at Happy Valley. Cliff spent early November collecting around Ararat and in mid-November returned to Ballarat collecting north of the city in areas including Creswick, Barkstead and Elmshurst.

Bill Murphy says Cliff 'was an inspiration and he was very generous with what he knew which was quite considerable.' He remembers Cliff saying to Pat: 'If you haven't got a plant list you don't know what is there. And if anything is in danger of being taken over, if you've got a plant list you are able to say what's there and why it should be protected.' Cliff also encouraged Pat to expand her collection, and after his visit, she continued to explore the region, updating her lists and collecting specimens (Murphy 2015). However, Pat's collection does not repeat Cliff's and clearly she was not trying to re-find species she had collected with him in 1978. Rather, her interest was in finding different species or the same species in locations where they had not been previously collected.

After Bill retired in 1987, he and Pat went out together and Bill took photographs of plants for her (Fig. 11). It was at this point that Pat's collection changed from occasional specimens of plants which were unusual in themselves or in a particular location, to an extensive collection of all plants, and the collection itself became her focus along with her plant lists. Bill also became knowledgeable about plants, but not to the same level as Pat, and he saw his role as supporting her in her botanical work. I asked Bill some of the questions that Frieda Knobloch would have liked to ask Ruth Aven (Knobloch 2005: 123). I also asked some other field naturalist couples what it meant to them to go out together to explore the local bushland. Peter Noble, whose wife Emily is Secretary of the FNCB and a passionate conservationist with a particular interest in orchids, explained that there is a lot of fun and enjoyment in the shared experience of going out into the bush together. Emily keeps extensive spreadsheets of the plants of Enfield Forest. Peter doesn't identify plants and doesn't keep lists, but if Emily shows him an orchid she is looking for he goes off and finds other patches of it for her. Peter, a psychologist,

Figure 11. Bill Murphy aged 89, lying full length on the ground to photograph an orchid, 2017. Photograph by Emily Noble

refers to shared activities of couples as 'social partnering' (Noble 2017). Another couple who belong to FNCB and go to most of the club excursions, but also try to go out together once a month, commented 'We just like to go out there and stop in a spot and see what we can see and I think that's the benefit of having two people out there because I walk past something and Paul says "Did you see that?"' (Swan 2017). Frieda Knobloch writes of the Nelsons 'It is obvious you were enjoying what you were doing, and if botany was the point, there was still much more going on' (Knobloch 2005: 89). In the case of Pat and Bill, there was certainly something 'going on' in addition to botany. Bill recalls 'We weren't kissy types, but if I found something that was rare, I'd get a kiss!' (Murphy 2017).

Frieda Knobloch writes about the associations of field work and experience, and how the experience of looking through the specimens she collected 'brought whole days back to me ... each of the plants I collected is a looking glass to step through...' (Knobloch 2005: 95). I mentioned this to Emily Noble, who is currently re-finding the plants on Pat's Enfield list with help from Bill Murphy, and adding new ones. Emily described in a similar way how the field work of finding plants becomes part of a whole experience. For Emily, who keeps records and makes submissions to land management authorities but doesn't collect specimens, it was not a specimen but a song that brought back a day of botanising for her:

> *Pete doesn't always like the same kind of music that I do and he commented 'I don't know why you like that song.' I first heard that song when I was driving out on Clarke's Road with Bill Murphy to find a Dainty Wasp Orchid [Chiloglottis trapeziformis W. Fitzg. – one of the plants on Pat's Enfield list from an FNCB excursion in 1999]. I had never seen a wasp orchid, so I was excited about seeing one, and I was going to a new place, and we were driving along the track with that song playing. It has such strong associations with that day that whenever I hear it I remember all the things about that day (Noble, 2017).*

Pat had favourite places to go looking for plants – specific areas in Enfield Forest, Mt Beckworth, Fell's Gully near Clunes – but she also liked to explore other places. As she said to Bill 'You never know what you're going to find' (Murphy 17 Feb 2017). Changing seasons, different years, dynamics of the forest (Hateley 2010: 162) and other factors not yet fully understood meant that plants might appear that had not been seen before in that location, or not for many years. Pat's anticipation of potential

discovery reminds me of a comment by Allan Sonsee to Jim Willis: 'For some reason I cannot, myself, put into words, I delight in plants. There is always something new to find out about them, some secret well kept...' (WILL002, letter from Allan Sonsee 24 Nov 1953).

When going out to look for plants, Pat would take a telephone book and sheets of paper with her and place specimens in the book immediately after they were collected. Then, at home, she would place them into a press made for her by Bill not long after Cliff's visit in 1978, which held up to 50 specimens. When the press was full, she would remove and file the specimens and begin again. She carefully labelled each specimen with information including date of collection, specific location, and often notes about specific features of the plant or the type of environment or plant community where it was growing (Murphy 2016).

Pat kept meticulous lists for each specific reserve or park. She made a new list each time she went out, so that she would not be influenced by previous findings. Then she would come home and update her ongoing list on the computer for that location, while Bill prepared dinner (Murphy 2016). Pat's lists for Enfield (1999), Mt Beckworth (2000), Canadian Reserve (2001), Linton BOC block (2002) and Bushranger Bushland Reserve (2005) are held by the FNCB and are still used by members.

Unlike Stella, Pat did not see herself as a conservationist. However, she was the FNCB's representative on the Bittern Lagoon Advisory Committee in 1980 and led working parties of inmates from Langi Kal Kal Youth Training Centre to plant vegetation around the Lagoon (FNCB Minutes July 1980; Aug 1980). The Lagoon was on Langi Kal Kal land, and the project included constructing a channel and mending breaches of Emu Creek to bring more water to the Lagoon, building a fence to keep stock out, using bulldozers to create islands in the lagoon and planting 500 trees and shrubs (FNCB Newsletter, Aug. 1980: 5). Community organisations including FNCB were invited to participate. In July 1981, FNCB member Dr Frank Harrap reported that brolgas had returned to the lagoon and in August 1981 Pat Murphy reported one brolga still at the lagoon (FNCB Minutes 1981). Bill Murphy recalls that there were several FNCB working bees to plant vegetation around the lagoon:

Some of those poor kids get a bad name but they haven't had much of a chance. We found they were good kids and enjoyed our company and we enjoyed them. I think Pat went once or twice and spoke to the kids about plants. She used to get on pretty well with the kids, probably having five of our own (Murphy 2016).

In the late 1980s, Pat was influential as a member of the study committee that succeeded in having the Ballarat–Skipton disused railway line turned into a reserve and 'rail trail'. Her detailed survey of the flora along this trail was used in the submission, along with a survey of a section of the trail by another member of FNCB, Roger Thomas (Harrison 1989: 17, 51). The report divides the railway line into segments, with detailed descriptions of the vegetation in each segment. In 1990, Pat was appointed the Conservation Council of Victoria's representative on the Local Advisory Committee for the rail trail (LAC 1990: 9). She reported back to the FNCB, and the President's Report in 1992 notes 'a special thank you to Pat Murphy for her work on the Ballarat to Skipton disused rail line study committee' (FNCB Minutes March 1992). Several specimens in Pat's herbarium were collected along this disused rail line.

Along with other members of FNCB, Pat and Bill Murphy also joined the Australian Plants Society Ballarat (formerly the Society for Growing Australian Plants – Central Highlands Group). In 1992, Pat wrote a series of 26 short articles for their newsletter, each describing a local orchid. She provided line drawings of the orchids to accompany the articles. These were botanical drawings showing the features of the plant (Fig. 12). The articles explain the local distribution and flowering time of each

Figure 12. Pat Murphy's line drawing of **a.** *Diuris chryseopsis* and **b.** *Pterostylis nutans* in SGAP newsletter, 1992

orchid and its method of pollination, as well as giving a description of its botanical features.

Pat was always interested in learning more about botany. In 1993 she and another FNCB member, Elspeth Swan, attended an adult education course in plant identification run by Ballarat University lecturer John Miller. It was an evening course including plant keys, terminology and plant characteristics. Elspeth recalls '... we went armed with a desk lamp and hand lens. I think Pat was interested in learning how to identify members of the daisy family ... We both had a level of skill before we went but Pat always had more patience than me and used her ID skills on probably a daily basis...' (Swan April 2017). Pat's herbarium includes 132 specimens of Asteraceae from 101 different species.

In 1993, Dr Ken McDonnell, President of FNCB, presented Pat Murphy with the FNCB Medal for her work as committee member and newsletter editor, excursion leader, speaker at club meetings, and representing the Club on community organisations (Fig. 13a). The minutes note 'Her botanical knowledge and willingness to share this with people is outstanding' (FNCB Minutes 1993).

In February 1995, bushfires swept through Enfield Forest, devastating some of the areas where Pat and Bill often went looking for orchids and other plants. Pat set out on a project to document the regeneration and for a whole year she and Bill visited Enfield every week, noting which plants reappeared. For the first few months, there was very little growing where the fire had burnt, but at that time Pat and Bill discovered Dereel Bushland Reserve, which had not been burnt and had a surprisingly rich variety of plants, particularly orchids. Then the plants started to reappear in the burnt areas. In May 1995, Pat reported to FNCB that Parson's Bands (*Eriochilus cucullatus* (Labill.) Rchb.f.), Bearded Midge Orchids (*Corunastylis morrisii* (Nicholls) D.L. Jones & M.A. Clem.) and Yellow Wood Sorrel (*Oxalis perennans* Haw.) were in flower, and *Grevillea bedggoodiana* was shooting (FNCB Minutes May 1995). In October 1995, she reported seeing owls, Scarlet Robins and Spotted Quail-thrush. After the year ended, Pat continued to observe the regeneration. In September 1996, she reported wallabies returning to burnt areas at Enfield, along with sightings of Spotted Quail-thrush and the reappearance of bush peas (FNCB Minutes Sept 1996). In December 1997, she reported that bushfires at Enfield had resulted in germination of pod-bearers' seeds (FNCB Minutes Dec. 1997). Some of the plants in Pat's herbarium were collected at Enfield Forest during this project, including Rock Fern and Blanket Fern.

In 2003, Pat was asked to survey water reserves managed by Central Highlands Water. Her lists are still in existence for nine of these reserves: Amphitheatre Reservoir, Bostock Reservoir, Centenary Reservoir, Evansford Reservoir, Mosquito Dam, Musical Gully Reservoir, Newlyn Reservoir, Talbot Reservoir and Wilsons Reservoir. This was an extensive task, including native and introduced flora as well as fauna seen during the surveys. The plant list for Bostock Reservoir alone includes 135 species.[5] It is interesting that there are no specimens from the water reserves in Pat's herbarium. Perhaps she did not have permission to collect during her surveys.

In later life, Pat worked on a field guide to the *Wattles of Ballarat*, intended for anyone interested in identifying the local acacias (Fig. 13b). This was her project, and although she died before it was finished, the guide was completed by the FNCB and Bill Murphy and was produced by the FNCB in 2009. The introduction explains that the idea for the publication originated with Pat, noting 'Pat had been quietly and methodically researching, seeking, documenting and identifying our district *Acacia* species. Bill had assisted and diligently photographed the selected plants' (FNCB 2009, 3). The guide covers acacias found within 40 kms of Ballarat and includes 21 naturally-occurring species and three introduced species. Some of Bill's photos were used along with others taken by FNCB members Carolyn Hall and John Gregurke.

Pat died on 23 September 2006. She had arranged to lead an excursion to a historic private property near Beaufort in November, and had already drawn up a comprehensive plant reference list. The Murphys' daughter Chris Chapman stepped in to lead this excursion in her mother's place, assisted by her father. Another daughter Marg and the Murphys' son Graeme and his wife and their three children also attended this excursion. (FNCB newsletter Nov 2006: 3-4) Pat's children share a love of plants and gardening, and

5 Lists were provided to me courtesy of Central Highlands Water.

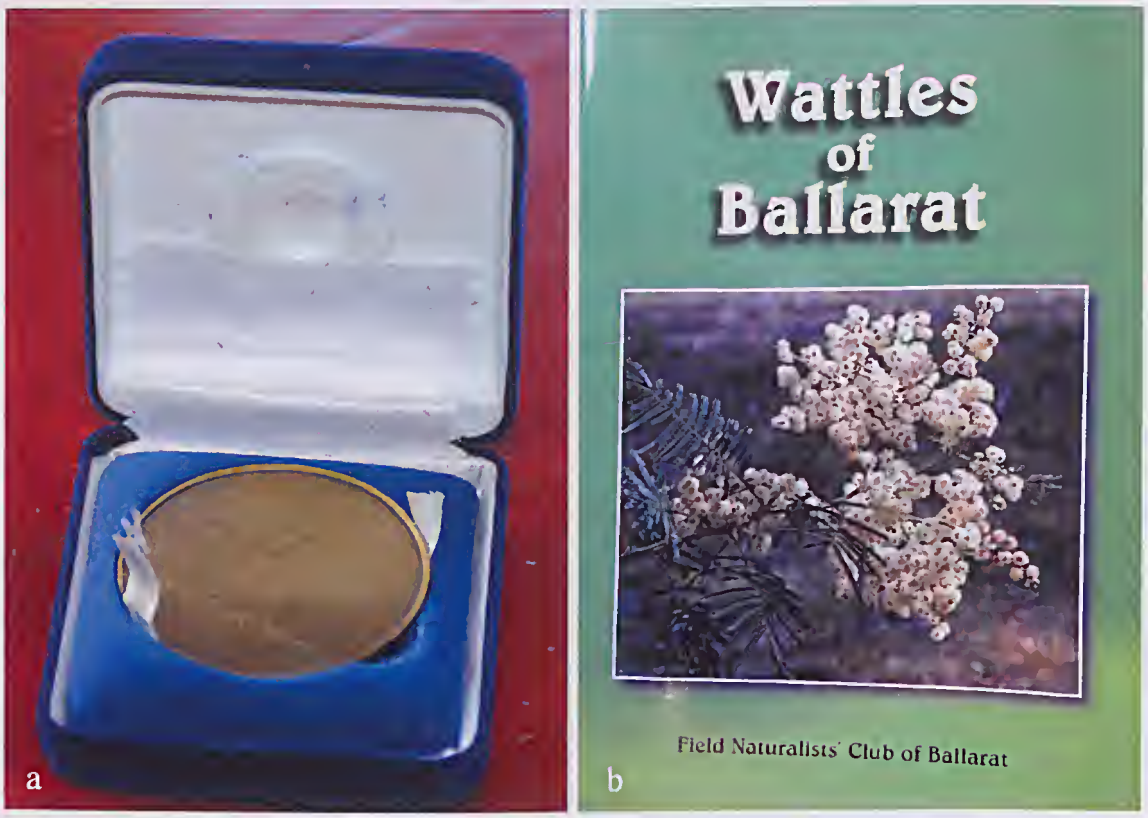

Figure 13 a. Pat Murphy's FNCB medal awarded 1993; **b.** *Wattles of Bollorot*

Table 1. Fifteen specimens contributed by Pat Murphy to National Herbarium of Victoria (MEL) during her lifetime.

Date	Name of species	Place of collection
June 1983	*Prosophyllum morrisii* (or Corunastylis morrisii)	Enfield State Park
28 June 1983	*Gleichenia microphyllo* R. Br.	Enfield State Park
4 July 1983	*Acianthus pusillus*	Dereel Lagoon Wildlife Reserve
23 Sept 1989	*Leucopogon glaciolis* Lindl.	Enfield Forest Park
29 April 1990	*Cuscuto epithymum* (L.) Murray	Mt Mercer
3 May 1992	*Eucalyptus ? oromophloio X yarraensis* Maiden & Cambage	Durham Lead
24 Aug. 1992	*Lycopodium deuterodensum* Herter	Wombat State Forest
7 Nov 1993	*Brochyscome debilis* Sonder	Clunes Forest
22 Feb 1995	*Eleocharis pusilla* R. Br.	Winter Swamp
1 Nov 1995	*Prosophyllum suoveolens* D.L. Jones & R.J. Bates	Dowling Forest Cemetery
22 Oct 1998	*Chiloglottis X pescottiono* R.S. Rogers	Enfield Forest
20 Sept 1999	*Chiloglottis X pescottiono* R.S. Rogers	Enfield
20 Sept 1999	*Chiloglottis tropeziformis* Fitzg.	Enfield
20 Aug. 2003 (2 specimens)	*Pterostylis chlorogrommo* D.L. Jones & M.A. Clem.	Linton Flora and Fauna Reserve

exchange plants for their gardens, but none have taken up botanising in their mother's footsteps. Chris explains that while they all admired their mother's ability to remember the botanical names of plants, this is not a talent her children have, though she says 'My son has that sort of recall memory. Sometimes it does skip a generation' (Chapman 2017). Marg Murphy agrees that they were all proud of their mother and appreciate her legacy of a love of plants, though for them it was the garden rather than the bush. She also points out that her generation work and have families and are 'time-poor', as are the next generation, though Bill Murphy takes his grandchildren and great-grandchildren along on field naturalists' excursions occasionally when they have the time (Murphy, M. 2017).

Fifteen specimens

During her lifetime, Pat sent fifteen specimens of thirteen different species to MEL between 1983 and 2003, either for confirmation of identification or because there were some unusual features about the plant or because it was unusual for the location where it was found (Table 1). Bill Murphy recalls driving to the Herbarium at least once with specimens in a large manila folder between cardboard. At other times Pat would place specimens between cardboard and then into envelopes and post them to the Herbarium.

These specimens were sometimes accompanied by letters explaining particular features of interest. A specimen of *Cuscuta epithymum* (L.) Murray (Common Dodder) collected on the Mt Mercer–Shelford roadside reserve (Fig. 14), includes the following note:

'Several years aga this plant cavered several kms af Paa-Themeda grassland alang this road. It was almost impenetrable, but has been samewhat diminished by firebreak burning and plaughing.'

Pat's herbarium

In 2007 Pat's husband Bill and daughter Margaret donated her collection of specimens to MEL. In order to be accepted, a collection must be of a high standard that will be useful to future researchers. Bill Murphy has the letter from Dr Josephine Milne, Collections Manager at MEL, dated 8 November 2007, thanking him for visiting to deliver Pat's herbarium 'comprising 62 folders of pressed and named specimens'. Dr Milne writes:

'Pat's callectians will be a valuable additian ta the scientific campanent af the State Batanical Callectian at the NHV [Natianal Herbarium af Victaria = MEL]. These callectians will camplement the 15 specimens callected by Pat that are already ladged in the herbarium' (Milne 2007).

I asked Dr Milne about the value of Pat Murphy's collection when I visited the Herbarium in April 2016. She explained:

'Pat had a really gaad knawledge of the flara of the area. The infarmatian that went with each specimen was detailed and useful. When we were offered her callectian by her husband and daughter, we already held same af her materials here, sa we knew the quality af her specimens and observatians. I alsa cansult with batanists here at the Herbarium wha help me to decide whether ar nat ta accept a callectian. In this case we were pleased to accept. It is also af interest because she was a female callectar' (Milne 2016).

Pat Murphy's herbarium has not been curated. It is stored in cupboards in the folders as it was donated in 2007. This enabled me to examine it as a collection, rather than as re-mounted individual specimens. Pat's specimens are arranged in folders by plant family. There are 1123 specimens, comprising 859 species, from 106 plant families. Not all of these are native. Some are introduced and some are weeds – because it is important to know where introduced species and weeds thrive as well as to know where there are valued native species.

Analysis

Pat Murphy's specimens were collected over 16 years, from 1989 to 2005, apart from three earlier specimens sent to MEL in 1983. *Gleichenia micraphylla* R.Br. (Scrambling Coral Fern) collected in Enfield State Park was cited by Beauglehole (1983) as an example of one of ca 480 rare and/or interesting species from the Ballarat study area (Figs. 15,16).

Apart from the specimens dated 1983, all of the others in Pat's herbarium were collected after Bill's retirement. As we know she collected from the late 1960s onwards, and Bill doesn't think she would have discarded any specimens, one possibility is that she collected for Cliff Beauglehole before 1983, though there is no actual evidence to support this. Cliff's Ballarat

herbarium, in which specimens are attributed to 'A.C. Beauglehole and FNC Ballarat' has been incorporated into MEL and a duplicate was given to FNCB which was gifted to Federation University in 2011. While there is no specific reference to Pat as collector, she was the person from FNC Ballarat who went with Cliff to find and collect specimens. Another possibility is that Pat's collecting may have been limited to FNCB excursions after Stella died in 1978, due to not having a companion to go out with apart from weekends until Bill retired. Bill recalls one day when they were out in the bush and noticed a man nearby who ducked behind a tree each time they looked up. They decided to go back to the car and leave the area (Murphy 2017). Not going out alone may have reflected Pat's concerns about personal safety alone in the bush while absorbed in a task, or it may have been that the activity was less appealing when not shared. Either way, if this were the case, it would indicate that botanical companionship was an important aspect of field work, and perhaps an essential one.

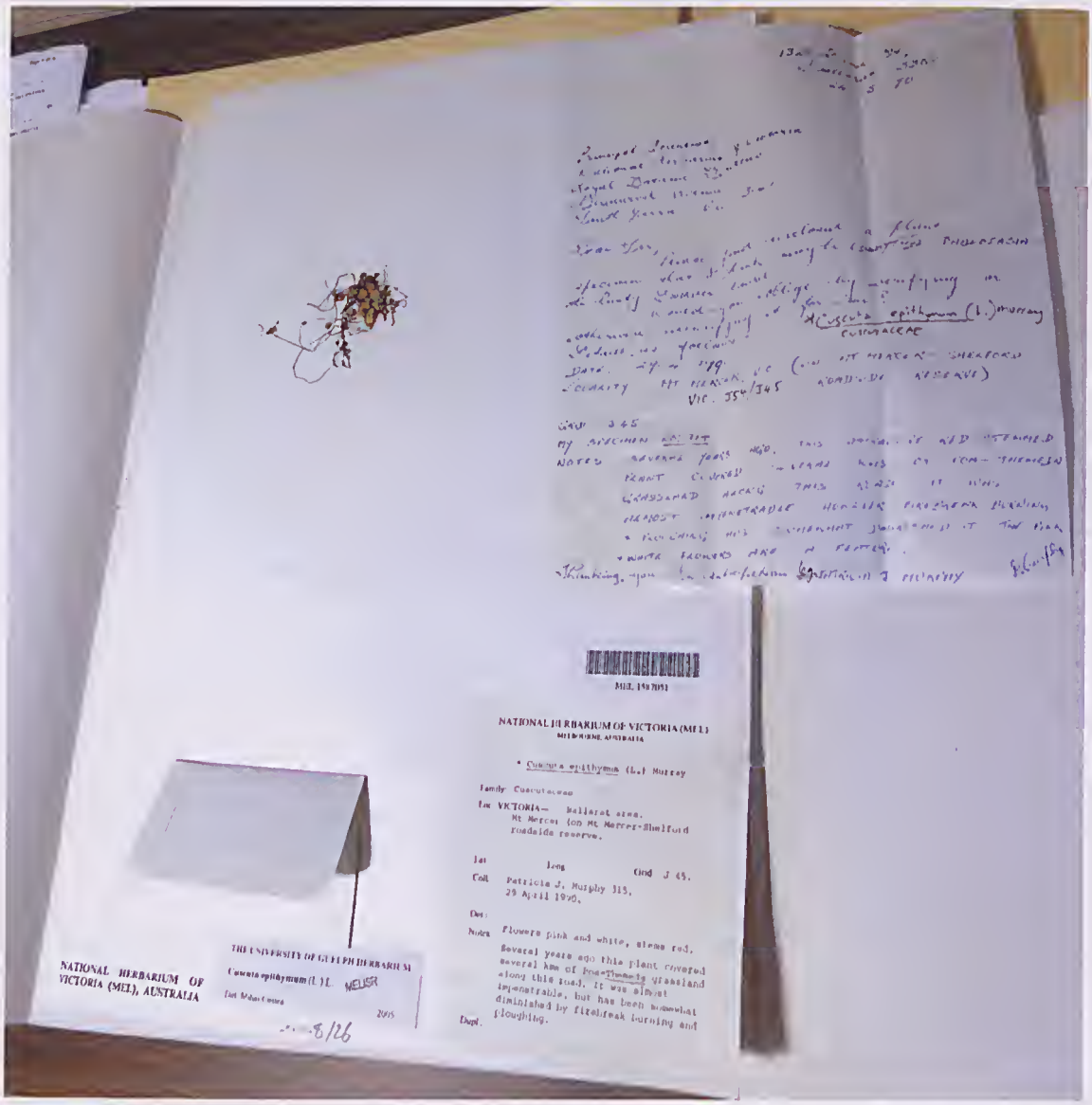
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE AUSTRALIA
Cuscuta epithymum (L.) Murray
Family Cuscutaceae
In VICTORIA— Ballarat area.
Mt Mercer-Ingliston Rd Mt Mercer-Shelford Roadside reserve.
Long Grid J 45.
Coll. Patricia J. Murphy 315, 29 April 1990.
Notes Flowers pink and white, stems red.
Several years ago this plant covered several kms of Prostanthera grassland along this road. It was almost impenetrable, but has been somewhat diminished by fire/break burning and ploughing.
THE UNIVERSITY OF GUELPH HERBARIUM
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA
MEL

Figure 14. Curated specimen of *Cuscuta epithymum* (L.) Murray collected by Pat Murphy, 29 April 1990, including letter from Pat. (MEL 1587051)

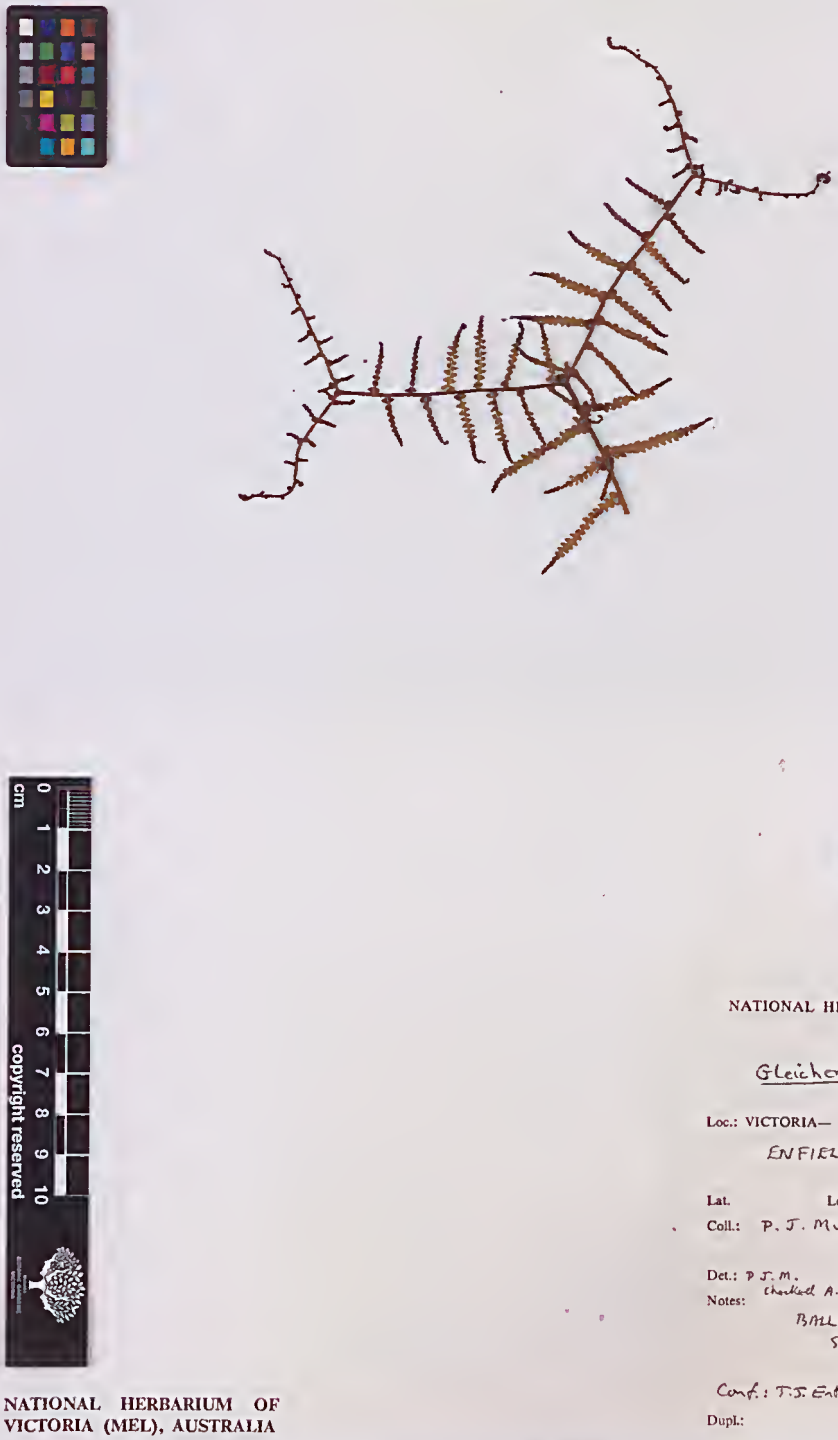

Figure 15. *Gleichenia microphylla* R.Br. Photograph reproduced with permission of RBGV. Curated specimen collected by Pat Murphy 28 June 1983 (MEL 1605300)

Figure 16. *Gleichenia microphylla* R.Br (Scrambling Coral Fern) at Enfield 2016. Photograph by Susan Kruss

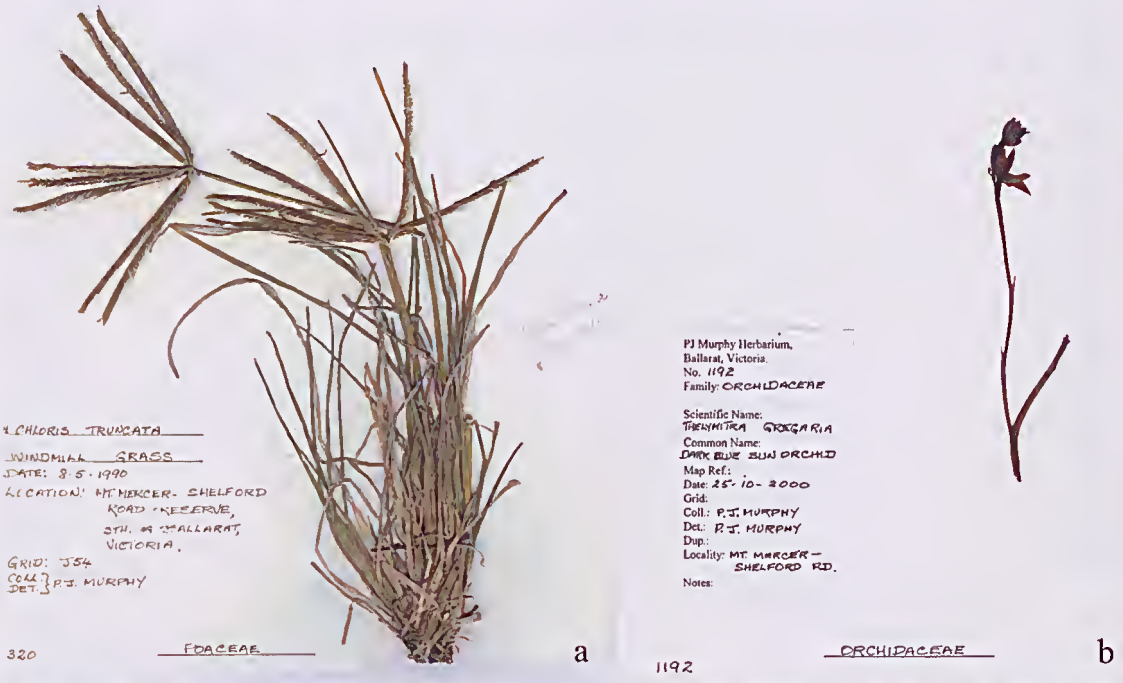

Figure 17. Collections by Pat Murphy. **a.** Specimen of *Chloris truncata* R.Br. (Windmill-grass) at Mt Mercer-Shelford Road Reserve 8 May 1990; **b.** Specimen of *Thelymitra gregaria* D.L.Jones & M.A.Clem. (Dark Blue Sun Orchid) at Mt Mercer-Shelford Road Reserve, 25 October 2000; considered endangered, endemic to the Victorian Volcanic Plains Grasslands

None of Pat's specimens is duplicated in Cliff Beauglehole's collection from his 1978 LCC survey of Ballarat. Therefore they complement Cliff's Ballarat collection. A brief comparison of Cliff's Ballarat collection of 352 specimens with Pat's herbarium is useful. Pat collected many more species than Cliff, reflecting the longer time period over which she collected. This is particularly noticeable in the families Asteraceae (101/49), Campanulaceae (15/4), Mimosaceae (17/6) and Orchidaceae (76/20), reflecting her particular plant interests. Cliff's collection includes 78 species not collected again later by Pat. In particular, Cliff collected six species of *Senecio* that were not collected by Pat, five species of *Trifolium* and seven species of *Eucalyptus*. Margaret Rotheram notes that one of Cliff's major interests was 'deficiencies' – plants known to be rare or have limited distribution in particular areas (Rotheram 2017). However, many plant families were not collected at all by Cliff in his Ballarat herbarium, but were later collected by Pat, including Poaceae of which she collected 83 species. Therefore taking the two collections together provides a much better understanding of the flora of the area than either one alone.

While Pat and Cliff both collected at Mt Langi Ghiran, Mt Buangor and Mt Cole, Pat did not collect in the area south of Ararat around Willaura and Rossbridge, but she did find many of the same species in locations much closer to Ballarat. From a field naturalist's point of view the area south of Ararat would have been considered to be in the Ararat Field Naturalists' Club area, with no connection to Ballarat, whereas the Mounts are located between Ballarat and Ararat and ideal for joint excursions of the Ararat and Ballarat clubs. It is interesting that the main submission to the LCC on the Mt Cole Range was written by the Geelong Field Naturalists' Club with the support of the Western Victorian Field Naturalists' Clubs Association. This was possibly because John R. ("Jack") Wheeler, brother of ornithologist Roy Wheeler and co-founder of the Field Naturalists' Club of Ballarat with Allan Sonsee, had moved to Geelong and was the President of the Geelong Club at the time (GFNC 1973). The Ballarat field naturalists were fully occupied with helping Cliff and preparing their own submission to the LCC which resulted in Enfield Forest and other areas being protected. Pat's collecting area also included Mt Beckworth and Wombat Forest, both close to Ballarat but part of different LCC regions.

Most of Pat's specimens were collected from reserved land – Flora and Fauna Reserves, State Forests, Forest Parks, Conservation Parks, National Parks, Roadside Reserves, Scenic Reserves, Heritage Parks, Bushland Reserves, rail reserves, town commons, water reserves and one specimen from Devil's Kitchen Geological Reserve. The remainder were collected from cemeteries, around lakes and swamps, river banks and roadsides (Fig. 17).

The vast majority of specimens in Pat's herbarium was collected from areas within a day's drive of Ballarat (1090 specimens). The exceptions are eight from the Lakes Entrance region in Gippsland where one of Pat and Bill's daughters was living, and some collected on holiday trips – one specimen at Eden in NSW in 1992, one at Kentucky State Park NSW in 2000, and two at Warrnambool in 1993. Two specimens were collected from the Grampians in 1994, one in 1996, one in 1998 and seven in 1999. In 1995 Bill and Pat travelled to South Australia, collecting a specimen from Little Dip Conservation Park, one from Beachport, one from Robe and one west of Millicent. In August 2001 they travelled to Broken Hill via Mildura, collecting one specimen at Pooncarie and one at Menindee and two at Speed in the Victorian mallee. Two specimens were collected at Sorrento in 1999.

Of the Ballarat specimens, approximately 130 were collected at Enfield, 38 from Rokewood, 29 from Lal Lal and 17 from Buninyong. Other sites included Dowling Forest, Mount Beckworth, Canadian Forest, Mt Warrenheip, Blackwood, Haddon, Creswick Forest and St George's Lake, Napoleons, Mt Mercer, Linton and Dereel, Mt Doran Forest north of Elaine, Langi Kal Kal area, Yarrowee Creek, Spargo Creek, Lake Wendouree, Lake Burrumbeet, Winter Swamp, Flax Mill Swamp, Dereel Lagoon, the rail reserves from Ballarat to Skipton, Haddon and Lal Lal, and Pat's home at 1320 Dana St.

Approximately 36 species collected along the Ballarat–Skipton disused rail line range from trees such as *Allocasuarina littoralis* (Salisb.) L.A.S.Johnson (Black Sheoak) to tiny wildflowers such as *Pauridia* (formerly *Hypoxis) glabella* (R.Br.) Snijman & Kocyan (Tiny Star) and include many native plants as well as both native and introduced grasses.

Some specimens were collected from a wider area around Ballarat including Paddy's Ranges and

Lillicur Forest near Maryborough, Sandon Forest near Newstead, Muckleford Forest near Castlemaine, Wombat Forest near Daylesford, Lerderderg State Park, Werribee Gorge, Fell's Gully north of Clunes, Buangor, Mt Cole and Langi Ghiran (near Ararat), Long Forest near Melton, the Rokewood–Cressy plains south of Ballarat, Lake Corangamite, the Brisbane Ranges, Inverleigh and Bannockburn.

Six specimens in Pat's herbarium were collected by her brother, Ern Perkins (1934–2016), a science teacher who became interested in botany separately from Pat and joined Colac Field Naturalists' Club and later

Figure 18 a., b. Specimens of *Pterostylis falcata* collected by Pat Murphy at Enfield 15 December 1989 and 28 November 1995, considered by Beauglehole (1983) a rare and/or interesting species from the Ballarat study area; **c., d.** *Pterostylis falcata* rediscovered at Enfield by Emily Noble, November 2016. Photograph by Susan Kruss

Figure 19 a. Specimen of *Thelymitra flexuosa* collected by Pat Murphy at Haddon Common on 24 October 1990, considered by Beauglehole (1983) a rare and/or interesting species from the Ballarat study area; **b.** *Thelymitra flexuosa* rediscovered at Enfield in 2016 by Bill Murphy. Photograph by Bill Murphy

Castlemaine Field Naturalists' Club. Ern's specimens included in Pat's collection were all from the Ballarat area – two from Lal Lal, and one from each of Guildford, Tullaroop Creek, Franklinford and Basalt.

Some of Pat's specimens were collected from roadsides, particularly along the Mt Mercer–Shelford Road. Bill Murphy says the Field Naturalists' Club of Victoria held an excursion to the volcanic plains south of Ballarat. Pat collected some specimens on that excursion and later went back to those areas at various times. Specimens from roadsides include grasses and wildflowers.

Pat's collection includes 107 specimens of orchids from 76 species. Genera include *Acianthus*, *Caladenia*, *Caleana*, *Calochilus*, *Chiloglottis*, *Corybas*, *Cryptostylis*, *Dipodium*, *Diuris*, *Eriochilus*, *Genoplesium*, *Microtis*, *Prasophyllum*, *Pterostylis* and *Thelymitra*. Of particular interest for the Ballarat region were *Thynninorchis huntianus* orth. var. D.L.Jones & M.A. Clem. (Elbow Orchid) in Enfield Forest Park in 1989, *Thelymitra flexuosa* Endl. (Twisted Sun Orchid) at Haddon Common in 1990 and *Pterostylis falcata* R.S.Rogers (Sickle Greenhood) at Enfield Forest Park in 1989 and 1995 (previously found at Enfield by Ted Bedggood in 1967 and recorded in the FNCB minutes as the first time it had been found in the Ballarat area). In 2016 Emily Noble re-found a significant colony of *Pterostylis falcata* at Enfield Forest Park, having looked for several years without success, perhaps because it grows in very wet areas and in this wet year was found growing in several centimetres of water in a low area of the forest (Fig. 18). It was also in 2016 that Bill Murphy found *Thelymitra flexuosa* on private property in Enfield Forest – a species Emily Noble has yet to see at Enfield (Fig. 19). Bill Murphy recalls walking down to Misery Creek with Pat and Helen Burgess the day Pat found *Pterostylis alpina* R.S. Rogers growing there, though there is no specimen in her herbarium (Murphy 17 Feb 2017). This orchid has not yet been re-found at Enfield.

Ballarat is not often associated with ferns, but Pat collected several species (Fig. 20) including *Cheilanthes austrotenuifolia* H.M.Quirk & T.C.Chambers (Rock Fern), *Cheilanthes sieberi* ssp sieberi (Narrow Rock-fern), *Asplenium flabellifolium* Cav. (Necklace Fern),

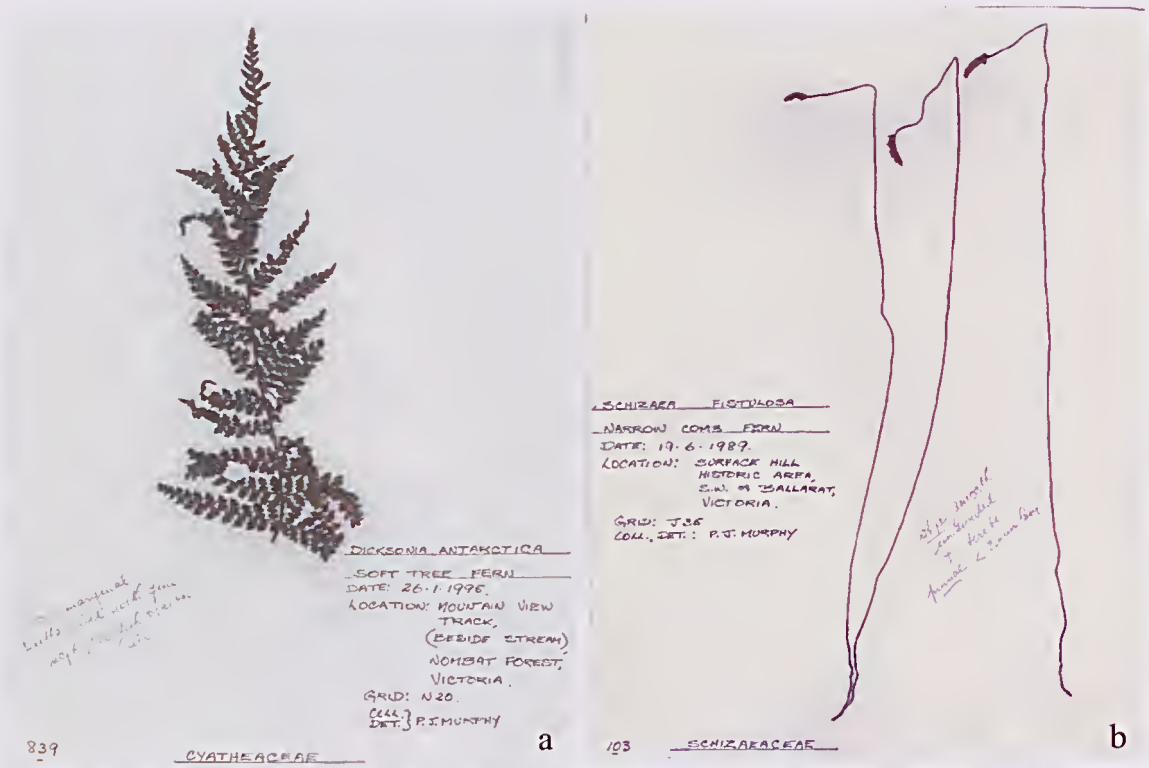

Figure 20. Collections by Pat Murphy **a.** *Dicksonia Antarctica* (Soft Tree-fern) in Wombat Forest on 26 January 1995; **b.** *Schizaea fistulosa* (Narrow Comb-fern) at Surface Hill, Enfield on 19 June 1989

Blechnum fluviatile (R.Br.) E.J.Lower ex Saloman (Ray Water-fern), *Blechnum nudum* (Labill.) Mett. Ex Luerss. (Fishbone Water-fern), *Blechnum wattsii* Tindale (Hard Water-fern), *Cyathea australis* (R.Br.) Domin (Rough Tree-fern), *Dicksonia antarctica* Labill. (Soft Tree-fern), *Histiopteris incisa* (Thunb.) J.Sm. (Bat's Wing Fern), *Hypolepis rugosula* (Ruddy Ground-fern), *Calochlaena dubia* (R.Br.) M.D.Turner & R.A.White (Common Ground-fern), *Polystichum proliferum* (R.Br.) C.Presl (Mother Shield-fern), *Gleichenia microphylla* R.Br. (Scrambling Coral-fern), *Sticherus tener* (R.Br.) Ching (Silky Fan-fern), *Hymenophyllum cupressiforme* Labill. (Common Filmy-fern), *Lindsaea linearis* Sw. (Screw Fern), *Todea barbara* (L.) T.Moore (Austral King-fern), *Tmesipteris obliqua* Chinnock (Long Forkfern), *Schizaea bifida* Willd. (Forked Comb-fern) and *Schizaea fistulosa* Labill. (Narrow Comb-fern). Jim Willis recorded both *Cyathea australis* (Rough Tree-fern) and *Dicksonia antarctica* (Soft Tree-fern) growing in mine shafts near Creswick, but not developing trunks (Willis 1934: 1). Pat found both species growing in Wombat Forest Park near Daylesford on river banks, not in mine shafts, but notes in the information with the Soft Tree-fern specimen that it has 'Some marginal Butts, clad with fine soft reddish brown hair'. Pat had observed tree ferns growing in mine shafts in Enfield State Park and in 1988 reported to the FNCB that these had been removed. The FNCB wrote to the Department of Conservation, Forests and Lands reporting the matter, which was followed by Pat accompanying the Department's officer Peter Muller to inspect the site (FNCB Minutes 6 May 1988 & 8 July 1988). However, little could be done as the ferns were gone.

In addition, Pat found a colony of Bushy Club Moss (*Lycopodium deuterodensum* Herter) at Surface Hill Historic Mining Area in 1989, which is the first time it was recorded in the Golden Plains Shire (Fig. 21). This colony was re-found by Emily Noble and Bill Murphy and an FNCB excursion was held in May 2016 to see numerous plants growing in a gully amongst the disturbed quartz from the nineteenth-century gold mining era (Fig. 22). A specimen was also collected by FNCB member Roger Thomas at Smythesdale on the Glenelg Highway in 1990. The only other instances of

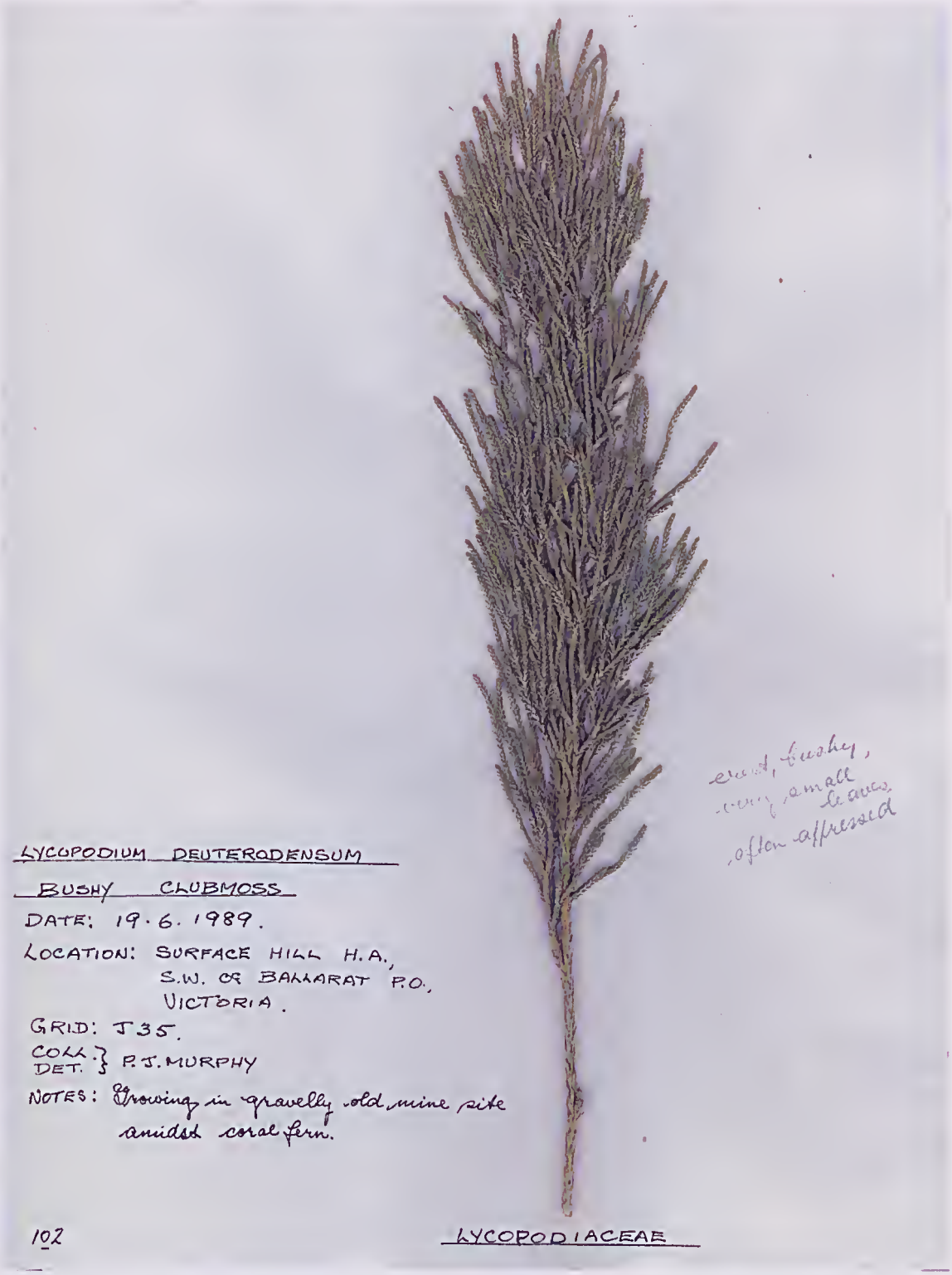

Figure 21. *Lycopodium deuterodensum* (Bushy Club Moss) collected by Pat Murphy at Surface Hill, Enfield on 19 June 1989

Figure 22 a, b. Bushy Club Moss growing at Surface Hill, Enfield in 2016. Photographs Susan Kruss and Emily Noble

Lycopodium deuterodensum near Ballarat recorded on the Australasian Virtual Herbarium (AVH 2017) are a specimen in an old gold mining area near Mt Beckworth in 1986 collected by G.F. Leitch and a group of about 50 plants found by Pat Murphy in 1992 in Wombat State Forest.

In 2016, a special mid-week excursion was held to try to re-discover an area within Enfield Forest that Stella Bedggood called 'the sandy patch'. This area was unusual as the surrounding soil was clay, and the flora there was different from other parts of Enfield Forest and the Ballarat region. Through the efforts of Stella on behalf of the FNCB it was set aside in the 1960s as Berringa Flora and Fauna Reserve, but it has since been subsumed into Enfield State Park and with the passing of the older field naturalists, its exact location had been forgotten. With some old maps and descriptions, we set out to find it, and there was considerable joy for some members in re-finding this location.

Pat Murphy is missed at the Field Naturalists' Club of Ballarat. In particular, her wealth of knowledge about plants and her understanding of how they fitted into the local ecology is a great loss to the Club. The Club noted Pat's contribution in its newsletter:

> *'She added immeasurably to knowledge of local bushland, diligently maintaining plant lists including keeping up to date with name changes and providing education to members and the wider community through leadership of excursions and presentations at meetings. Pat was a keen naturalist and could be relied on to know where there were rare plants and to assist with the preparation of submissions when needed. Pat's special interest was plants but not only the things that are easily seen. She would often name and point out the beauty in small plants' (FNCB Newsletter, Nov. 2006: 3).*

Bill Murphy told me that shortly before Pat died she said to him 'The Field Nats Club has been the highlight of my life' (Murphy 2017).

Conclusion

Lack of formal tertiary education for intelligent women in Australia in the first half of the twentieth century left a gap in their lives which was not fulfilled by the domestic role of wife and mother. These women sought something else to exercise their minds, particularly after the end of the Second World War when Australian families were able to enjoy a higher standard of living and women with school-age children were not totally occupied with the domestic necessities. For Stella Bedggood and Pat Murphy, who had the interest and intelligence and enjoyed the process of discovery and a meticulous attention to detail, this intellectual gap was filled by the study of botany in their local area. Learning was a source of enjoyment as well as satisfaction in knowing that they were adding to knowledge and understanding of the local environment, and also to a wider sphere of botanical knowledge. Field naturalists' clubs provided an ideal environment for women to explore and learn in a way that was socially acceptable and could be fitted in around family life. While this article concentrates on Pat Murphy in particular, it is likely that this applied to other women engaged in botany through their local field naturalists' clubs.

Pat Murphy's contribution to botany included her extensive knowledge of plants of the local area which was used in submissions to council and government relating to land management decisions. Her knowledge was respected by local and Departmental officials, and she was asked to survey the plants along the Ballarat–Skipton Rail Trail and the Ballarat Water Reserves and lead the plantings at Bittern Lagoon. Her plant lists are valued by the FNCB and used by them to confirm historical presence of species. In addition, her collection at MEL will be of value into the future. Being able to see the collection before curation provides a unique perspective on the breadth and extent of Pat's role as a collector, including the significant number of plant families and individual species she collected, and the systematic way her collection is arranged by plant family.

The concept of botanising as shared experience adds another dimension to understanding Pat Murphy as a collector. The joy of sharing the process of discovery with another person, of learning through 'botanical relationships' suggested by Frieda Knobloch, can be applied to both Pat's mentor in botany, Stella Bedggood, and her husband Bill, as well as the broader context of field excursions with the Field Naturalists' Club of Ballarat. Pat Murphy's collection is a significant contribution to botanical knowledge, but a study of her life reveals the human and personal as well as the scientific dimensions of botanical collecting.

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Appendix 1. Specimens held at National Herbarium of Victoria (MEL) collected by members of the Field Naturalists' Club of Ballarat.*

Name	Year of collection	Location where collected	Plant family
Allan Sonsee	1942	Darwin	*Gomphrena canescens* R.Br. *subsp. erythrina* J.Palmer
	1944	Springmount near Creswick	*Pterostylis rubescens* (D.L.Janes) G.N.Backh. formerly *Speculantha aurifera* D.L. Janes
	1946	Basalt forest block (Kooroocheang)	*Philotheca verrucosa* (A.Rich) Paul G. Wilson *(farmerly Eriostemon verrucosa)*
	1952	White Hills, Creswick	*Corybas diemenicus* (Lindl.) Rchb.f.
	1953	Faster, Gippsland	*Microtis parviflora* R.Br. (2 specimens)
	1953	Lang Paint, Creswick	*Calochilus campestris* R.Br.
	1953	Long Point, Creswick	*Prasophyllum odoratum* R.S.Rogers
	1954	Creswick	*Clematis microphylla* DC. *(first collectian of this species in this district)*
	1961	Creswick	*Borago affocinalis* L.
	1964	Creswick	*Thelymitra flexuosa* Endl.
	1964	Hepburn	*Drosera macrantha* Endl. *subsp. macrantha*
	1968	Springmaunt near Creswick	*Trametes (fungus)*
Stella Bedggood	1967	Enfield	*Chiloglottis reflexa* (Labill.) Druce
	1973	Enfield	*Calochilus robertsonii* Benth.
	1973	Enfield	*Epacris impressa* Labill.
	1973	Enfield	*Acacia provincialis* A.Camus
	1975	Durham Lead	*Pterostylis nutans* R.Br.
	1976	Talbot	*Eutaxia micraphylla* (R.Br.) C.H.Wright ^ Dewar var. micraphylla
Bon Strange	1961	Kingower	*Melaleuca wilsonii* F.Muell.
	1961	Sago Hill near Enfield	*Corybas incurvus* D.L.Janes & M.A. Clem.
	1961	Berringa Reserve, Enfield Farest	*Caladenia clavigera* A.Cunn. ex Lindl.
	1961	Berringa Reserve, Enfield Forest	*Prasophyllum odoratum* R.S.Rogers
	1962	Little Hard Hills, Enfield Forest	*Grevillea bedggoodiana* J.H.Willis ex McGill. (2 specimens)
	1962	Little Hard Hills, Enfield Forest	*Pultenaea gunnii* Benth. subsp. gunnii
	1962	Dunolly	*Pterostylis curta* R.Br.
	1962	Near Eildon	*Pultenaea williamsonii* Maiden
	1963	Enfield district	*Cryptastylis subulata* (Labill.) Rchb.f.
	1963	Enfield district	*Spiranthes australis* (R.Br.) Lindl.
	1963	Parcupine Ridge, NNE of Daylesford	*Pultenaa graveolens* Tate
	1963 Feb 20	Misery Creek near Dereel	*Acacia verticillata* (LHer.) Willd. subsp. verticillata
	1963 Sept 13	Misery Creek near Rokewood Junction and Dereel	*Acacia verticillata* (LHer.) Willd. subsp. verticillata
	1964	Mt Beckwarth	*Diuris pardina* Lindl.
	1964	Mt Beckworth	*Diuris palachila* R.S.Rogers
	1964	Mt Beckworth	*Thelymitra macmillanii* F. Muell.
	1964	Enfield	*Calochilus rabertsonii* Benth.
	1966	Long Gully, Creswick	*Calochilus robertsonii* Benth.
	1966	Leigh River east of Mt Mercer	*Correa glabra* Lindl.

Name	Year of collection	Location where collected	Plant family
	1977	Grampians	*Boronio coerulescens* F. Muell. subsp. coerulescens
	1982	Murrindindi, South Eastern Highlands	*Pultenaea williamsonii* Maiden
Pat Murphy	1983-2005	Mainly around Ballarat but also other parts of Victoria, NSW and SA	1138 specimens from many plant families
Florence Chuk	2014	Enfield	*Amonito ononiceps* (Berk.) Sacc.
Roger Thomas**	1990		*Lycopodium deuterodensum* Herter
	1991	Brown Hill, Ballarat	Eucalyptus ? viminalis X yarraensis Maiden & Cambage
	1991	Moorabool	*Bracteantha subundulota* (Sch.Bip.) Paul G. Wilson
	1991	Golden Plains	*Grevillea bedggoodiono* J.H.Willis ex McGill. (2 specimens)
	1991	Pyrenees	*Daviesia laevis* Crisp
	1991	Pyrenees	*Xerochrysum polustre* (Flann) R.J. Bayer
	1992	Moorabool	*Senecio psilocarpus* Belcher & Albr. (2 specimens)
	1992	Ararat	*Monotoco glouco* (Labill.) Druce

*This information is taken from the Australian Virtual Herbarium or from actual specimens viewed at RBG Herbarium. Specimens referred to in other sources but not listed on AVH and not found at the RBG Herbarium have not been included.

** Roger Thomas is listed as additional collector on another 26 specimens.

Appendix 2. Artworks and photographs by Field Naturalists' Club of Ballarat members held at National Herbarium of Victoria (MEL).

Name	Geographic area	Items
Mary White	Anglesea area after leaving Ballarat.	Paintings of plants and marine creatures
Peter Fry		Photographs of flora

Muelleria

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ROYAL BOTANIC GARDENS VICTORIA

On the threshold of mycology: Flora Martin née Campbell (1845–1923)

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Introduction

Flora Martin née Campbell mostly features in the history of mycology as a collector of fungi (Willis 1948; May 1990; May and Pascoe 1996). Recent investigations have revealed her to be a pioneer woman scientist who not only collected fungi but published, presented, experimented in, and gave expert testimony on, the subject of mycology (Maroske & May in press 2018). In addition, she made significant contributions to the development of this discipline in Australia, facilitating the appointment of professionals, and the issue of key publications.

As she was already an adult when Australian universities admitted women in the 1880s (Kelly 1993), Flora had to turn elsewhere for a scientific education. Her science of choice, mycology, was an emerging discipline in the latter part of the nineteenth century, and it offered students and researchers opportunities to discover new species, to investigate their relationships with other organisms, and their impact on practical disciplines such as agriculture, forestry and horticulture.

The struggle for acceptance and recognition faced by the first professional women scientists is an established area of historical research (e.g. Creese 1998, 2004, 2010, 2015). Less well known are the stories of women who attempted to reach their scientific goals in an era when the great amateur tradition of natural history was giving way to academic science. Flora Martin exemplifies the situation of these women, especially in the colonies where she not only faced barriers due to her gender, but

Abstract

Flora Martin née Campbell was a pioneer mycologist active in collecting, research, publication and advocacy in nineteenth century Australia. Standing in the way of her scientific advancement were a number of substantial barriers, including entrenched prejudice against women, and the relatively isolated and undeveloped state of her colonial scientific community. Despite this, she still managed to achieve a suite of scientific firsts for a woman working on Australian fungi. Recent archival discoveries indicate that for two decades she was at the centre of Australian mycological activity, with connections to fellow scientists in a number of Australian colonies, New Zealand, the United Kingdom and Europe.

Key words: mycology, botany, colonial Australia, women, amateurs, professionals

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also because of her isolation from the main centres of scientific research in the northern hemisphere.

A precocious talent with strong self-belief, Flora revealed the limitations of a gendered and hierarchical scientific system that was capable of inspiring gifted colonial women, but also frustrating them. Aware of her unequal treatment, she made acerbic comments on the shortcomings of others, further setting her apart from colleagues who accepted the *status quo*. While significant gaps remain in her story, it is clear that Flora was an exceptional individual, not only for her contributions to mycology, but also because she dared to make them.

Background and early years

Colonial Australian botany and mycology

Australia offered European botanists an enviable field of research with diverse and highly endemic vegetation. In the first seventy-five years of British settlement, much of this investigation was undertaken by short-term visitors to the various colonies, or longer-term users of Australian materials in northern hemisphere herbaria and museums. In Australia itself, the discipline of botany was imported with settlers as an established part of school curriculums, and taught at the first Australian universities, but opportunities for paid professional careers remained remote up to the end of the nineteenth century (Gascoigne & Maroske 2013).

German-educated Baron Ferdinand von Mueller (1825–96) dominated the Australian botanical scene from the time of his appointment as Government Botanist in Victoria in 1853, eventually drawing thousands of others, including women, into his research projects through a large network of collectors (Maroske 2014). Mueller focused his research on higher plants, not having sufficient funds for the resources needed to cover the lower plants or cryptogams (which included fungi). At first Mueller sent his own and his collectors' fungal specimens to the Rev. Miles Joseph Berkeley (1803–89), a clergyman and independent scientist in Britain for identification and description (Mueller 1881).

While it was an exciting era for the study of fungi, with new discoveries in fungal reproduction and morphology (English 1987: 157), Australian species did not contribute to these developments. Berkeley waited twenty years to work on Mueller's specimens, in part because they were of poor quality (May 1990), but the delay led to fungi being 'less studied than any other series of Australian plants' (Mueller 1872). Moreover, Berkeley's initial belief that most Australian species 'were identical with species in Europe', tended to discourage local research (Mueller 1891a). This was all to change in the 1880s when new participants entered the field, and the richness of Australian mycology began to be revealed.

Flora's childhood and education

Flora Mary Campbell was born at Dilston, Tasmania on 22 February 1845 (Anonymous 1845). Thereafter she disappeared from the historical record for more than thirty years. When added to a lack of surviving anecdotes about her childhood, this means details of her early life remain frustratingly speculative. Nevertheless, while Flora did not record her own story, she did see merit in copying down her father's reminiscences just before he died (Martin 1890). These provide an indirect outline, in part, of her chronology, and are especially revealing in regard to Alexander Campbell's (1805–90) role in her life.

Like other precocious women, Flora probably developed scientific confidence, and the contacts to further it, in the context of a strong father-daughter relationship. The importance of this kind of bond is evidenced in the life of an exact contemporary of Flora's in New South Wales, Georgina King (1845–1932). Her father, the Rev. George King (1813–99) sympathised with her thirst for knowledge, and when she exhibited a passion for geology he described her proudly as 'his little philosopher'. In an assessment that could be applied to Flora, Georgina's biographer claimed that she inherited the Rev. King's drive, displaying his 'Celtic pugnacity' in her efforts to become acknowledged as a scientist (Carter & Cross 2013).

Flora's father followed his brothers from Scotland to the colony of Tasmania in 1825. After eleven years he moved to the colony of Victoria and settled at Port Fairy as a whaler and ships' captain. Powerfully built and charismatic, he became known as 'Port Fairy Campbell', and also left his name on the coastal town of Port Campbell (Anonymous 1887). Aged 40, Alexander married Mary Ann Coulson (Anonymous 1844), and his wife returned to her family home in Tasmania to give birth to their first child, Flora Mary. A second daughter

(Ann Eliza), and a son (Alexander Nicholson), were born at Port Fairy in 1847 and 1851 respectively.[1]

Just before the discovery of gold in 1851, Flora's father was appointed the first harbourmaster of the Port of Melbourne. The Campbells moved into a series of dwellings in the heart of the growing city, with a fourth and final child, George Neil Campbell, joining the family in 1856.[2]

As in other middle-class families, the Campbell children were probably educated at home, possibly by their mother and/or a series of private tutors. Boys and girls were usually taught different subjects at this time, but the lack of educational facilities in early Melbourne may have allowed Flora more freedom to pursue her interests than children of the next generation. She clearly learnt to read, write and to draw, and was given a thorough Christian education in the context of the Presbyterian Church. It does not seem, however, that she had any exposure to Latin, an important language in nineteenth-century scientific literature, and especially in taxonomy.

Botanical and mycological awakening

Botanical awakening

Flora was 24 when her father retired in 1869 (Anonymous 1869b). Still in good health, he decided to take up grazing cattle on 650 acres at Fulham, in the Gippsland region, 200 km east of Melbourne. Here, according to Flora, he did 'fairly well' (Martin 1890). It was at Fulham that Flora began a serious study of botany, claiming in 1888 that she had been 'at' this subject for fifteen years (Campbell 1888a: 129). The identification and illustration of plants was a respectable interest for young ladies (Jordan 2005), and the diverse and novel vegetation in Australia was an additional incentive for budding naturalists to take up botany. In this regard, the still substantially native vegetation of Gippsland offered a rich and dramatic landscape for Flora to explore. Later it was claimed that 'in her young days', she was 'a lover of plants, and a diligent student of botany' (Pitcher 1925: 176).

In 1874, Flora acquired part two of Balfour's *Class book of botany* (Balfour 1852–4), which was 'much studied, judging by the multitudinous marginal notes and underlinings throughout' (Pitcher 1925: 177).[3] By the 1880s she came to regard Balfour as old-fashioned, and lamented the fact that 'in our Herbarium and University they still use and recommend [his books]' (Campbell 1885b; Campbell 1889). Flora also acquired the seven volumes of Bentham's *Flora Australiensis*, a substantial and expensive work, and the most up-to-date and comprehensive treatment of Australian flowering plants and ferns (Bentham 1863–78, Pitcher 1925).

Both Balfour and Bentham recommended students of botany make their own herbarium, or collection of dried plants. This was to facilitate the identification and exchange of specimens, and to establish a collection for future reference (Balfour 1852–4: 1075–1082, Bentham 1863: ch. 4). Flora's earliest surviving dated specimens are from Fulham in January 1880,[4] but she probably began her herbarium several years earlier (Campbell 1888a).

In 1877, Flora's Australian botanising was interrupted for a couple of years, when her father took his family (minus the sons), on a tour home to Scotland. They left on *Highflyer* in March and returned on *Loch Garry* in August the following year (Anonymous 1877; 1878). Whatever the discomforts of long-distance travel, Flora apparently took them in her stride, and she made a number of substantial sea and land journeys in the next decade.

Mycological awakening

The year after returning to Australia, Flora made a two-month journey to the colony of Queensland. She sailed on *Ly-ee-moon* in July 1879 from Melbourne to Sydney, with Miss Effie Gerrand and Effie's cousin John Gerrand (neighbours in Gippsland) for company (Anonymous

1 No. 8225/1847, birth registration of Ann Eliza Campbell https://online.justice.vic.gov.au/bdm/indexsearch.doj viewed January 2017. No 9284/1851, birth registration of Alexander Nicholson Campbell https://online.justice.vic.gov.au/bdm/indexsearch.doj viewed January 2017.

2 In 1856, Mary Ann Campbell gave birth 'at her residence, Bourke-street' (Argus, Melbourne, 7 January 1856: 5). In 1863, the address of 'Campbell, Alex., harbourmaster' was '373 Spencer-street' (Anonymous 1863). Between 1866 and 1869, his address was '119 Spencer-street' (Anonymous 1866, 1868, 1869a). No. 567/1856, birth registration of Neil Campbell https://online.justice.vic.gov.au/bdm/indexsearch.doj viewed January 2017.

3 The library catalogue at the Royal Botanic Gardens Victoria states that one of the library's three copies of Balfour (1852–4) belonged to Flora Campbell. An examination of the copies, however, was inconclusive.

4 e.g. MEL 1601090A *Rytidosperma caespitosum* (Gaudich.) Connor & Edgar.

1879a).[5] Just what prompted Flora to set out on this trip is not clear, but it may have been to visit her brother, Alexander Jr, who eventually died in Queensland.[6]

On the Sydney to Brisbane leg of the voyage, Flora and her companions were joined by a famous Australian naturalist, Father Julian Tenison-Woods (1832–89) (Anonymous 1879b; Borchardt 1976). Although mainly occupied with writing government reports, Tenison-Woods was also in the process of preparing a foundational paper on Australian mycology with Queensland botanist Frederick Manson Bailey (1827–1915).[7] Later Flora remembered Tenison-Woods noting, and lamenting, the rapid spread of weeds like cacti and lantana in Queensland (Campbell 1885c).

It is possible that Tenison-Woods was responsible for sparking Flora's interest in fungi (which she dated from 1879) (Campbell 1885c). In the mycology paper, Tenison-Woods gave an overview of the discipline and its possibilities in Australia, stating clearly that his purpose was 'to popularize the subject with a view to stimulate enquiry' (Tenison-Woods & Bailey 1882: 51). The paper acknowledged about a dozen collectors, and made a single reference to 'Miss F. M. Campbell' as the contributor of a specimen of *Irpex flavus* Klotzsch,[8] a bracket fungus, from the river port of Ipswich in Queensland (p. 73).

Frederick Manson Bailey

Tenison-Woods' co-author, Bailey, was a self-taught Australian botanist initially residing in South Australia and from 1861 in Queensland. He published extensively on the vegetation (including fungi) of Queensland over a long career as Government Botanist (Marks 1969). Flora made contact with Bailey in Brisbane (probably facilitated by Tension-Woods), and he became the first professional botanist with whom she developed a collegial relationship (Pitcher 1925).

While none of Flora and Bailey's correspondence has been found, his letter registers indicate that they communicated almost monthly from 1879.[9] In an early letter, Bailey sent Flora a recently issued census of Brisbane plants (Bailey 1879; Bailey n.d.), and continued to supply her with his works in the same way as he did other highly regarded correspondents (Pitcher 1925).[10]

Like Flora, at this stage of his career Bailey was a relative novice in fungi. No botanists in Australia were yet naming new species in this group, not even Ferdinand Mueller, and the flow of specimens was to taxonomists overseas. Bailey introduced Flora to a handful of international experts, and initially forwarded her specimens to them. The first new taxon based on one of Flora's collections was *Parmelia campbelliae* C.Knight (as '*Campbellii*'),[11] a lichen, gathered by her at Mt Kosciuszko, New South Wales. Bailey forwarded the specimen to Charles Knight in New Zealand, and he published a description (Knight 1884).[12]

Miles Joseph Berkeley and Christopher Broome

Bailey also forwarded Flora's specimens to the then foremost mycologists in the English-speaking world; the Rev. Miles Joseph Berkeley and his research partner Christopher Broome (1812–86). Based in provincial England, they published a series of articles on fungi from different countries, including Australia.

Berkeley and Broome's first article to cite Flora's collections was published in 1882, although it was mainly concerned with Queensland fungi (Berkeley & Broome 1882). In a letter to Berkeley a couple of years later, Broome described Flora's first specimens as 'very bad' (Broome 1884), being both insufficient in

5 The names of Flora and the Gerrands occur in the passenger lists of each part of voyage to and from Queensland, which suggests they were travelling together.

6 Alexander Nicholson Campbell died in Burketown, Qld, on 21 April 1891, but was buried with his parents in the Brighton Cemetery, Melbourne https://billiongraves.com/grave/Alexander-Campbell/15156272#/ viewed March 2017.

7 The paper was read before the Linnean Society of NSW on 25 February 1880.

8 Now known as *Flavodon flavus* (Klotzsch) Ryvarden (May et al. 2004).

9 In and Out Letter and Packet Book, Letter Register, Colonial Botanist, 1879–1894: Queensland Herbarium, Toowong, Qld, Australia.

10 Flora's copy of Bailey (1883) is in the library at the Royal Botanic Gardens Victoria, inscribed: 'To Miss Flora M. Campbell with the authors compliments 4-8-83'.

11 Now known as *Hypogymnia mundata* (Nyl.) Oxner ex Rass. (McCarthy 2017).

12 The plate associated with this article is labelled *Thysanothecium Campbelli* Knight. In undated notes with the type specimen, Bailey states: 'This curious Lichen was collected by Miss F. M. Campbell a lady to whom I am indebted for many botanical specimens she gathered this on Mount Kosciusko in Victoria and if you find it new do me the favor to let it bare her name I have not had a new plant from her that I could do so as she has not been further north than Brisbane and of the Southern Plants one seldom finds them new for Baron Mueller has his collector out in those parts I do not approve in general of naming after persons but you see it is the best way to them for their kindness in sending us specimens' (Museum of New Zealand Te Papa Tongarewa Herbarium).

sample size, and often mouldy. As Mueller had already experienced, however, this is a common problem for novice mycologists, because fleshy fungi are notoriously difficult to preserve, and even when successfully dried, shrink and change shape considerably (May 1990: 267).

The solution was to improve collections and to make detailed notes and illustrations to accompany them, and Flora quickly adopted these practices when encouraged to do so. In a surviving letter to Christopher Broome she promised: 'I will try and send in a better condition and larger quantity', explaining that while she often started out thinking she had gathered a 'great number' of specimens, the final collection was usually much reduced by the vicissitudes of travel and the process of drying specimens (Campbell 1885b).

In 1887, Berkeley and Broome published a second article citing Flora's specimens, and made three the basis of new species. These included *Tympanis toomansis* Berk. & Broome, a fungus growing on *Banksia* L.f. cones found at Tooma, NSW (Berkeley & Broome 1887: 222). This species, in turn, has now become the type of an iconic endemic Australian genus, *Banksiamyces* G.W. Beaton (Beaton & Weste 1982). Berkeley and Broome were especially interested in the truffle-like fungi sent by Flora, and suggested 'that a great deal remains to be done among these Orders in so vast a country as Australia' (Berkeley & Broome 1887: 217).

Botanical visiting

The trips that Flora made to Scotland and Queensland were an accepted part of the life of middle-class families in the nineteenth-century. It was common practice for ladies to visit and stay with relatives and friends for extended periods. Flora's level of engagement in this activity, however, was unusual, especially as she combined visiting with botanising, amassing hundreds of specimens of flowering plants and cryptogams.

Absent from home for months at a time, she often toured through remote country where roads were primitive and travelling conditions uncomfortable. In 1885, she found a 'beautiful' specimen of *Clavaria* L. (coral fungus) in Tasmania, and carried it 'five miles on horseback[,] 10 miles in a waggonette, then packed for the sea voyage [to Victoria] 240 miles', before posting the specimen more than 10,000 miles to Broome in the northern hemisphere (Campbell 1885d).

Campbell family networks and contacts ensured that Flora found hospitality at many pastoral homesteads, although few of these can now be identified.[13] It is also unlikely that she travelled alone, but unfortunately the names of her companions have also mostly been lost. Beenak on the southern slopes of the Great Dividing Range was a favourite collecting locality, which Flora described as 'a very wild mountain district' and she lamented the fact that 'there is no place for a lady to stay in except the selectors invite you and their homes are very rough' (Campbell 1885b).

Because of the loss of most of Flora's letters, surviving specimen labels, and records of her correspondence with Bailey, provide the surest evidence of where and when she conducted her botanical excursions. While the geographical range of most colonial Australian women collectors was usually limited to around their homes, she ventured to four colonies; Tasmania, Victoria, New South Wales and Queensland (Maroske & Vaughan 2014). From July 1880 to early 1881 Flora was in New South Wales including at Tooma and 'at the base of Mt Kosciuszko', the tallest mountain on continental Australia. From August 1881 to March 1882 she was based at Kiewa in northeast Victoria, and later she also visited Mt Buffalo, Mt Hotham, and the Grampians in the same colony. Flora recruited her own network of collectors among fellow settlers, who were responsible for at least some of the specimens attributed to her in surviving herbarium data sets (Campbell 1885e).[14]

Societies and mentors

Field Naturalists Club Of Victoria

In April 1882, Flora's father sold his Fulham farm and moved his family back to Melbourne. At first they rented on Punt Hill, South Yarra, not far from the Botanic Garden, but the following year Alexander Campbell bought a cottage nearby at 38 Caroline Street, which became Flora's new home base (A. Campbell 1885).

Being in Melbourne allowed Flora access to the

13 An exception relates to a specimen of *Buellia* De Not. collected by Flora at Wooriwyrite in November 1886. Wooriwyrite was the property of the Scottish born pastoralist Thomas Shaw who was probably well known to the Campbell family (Wooriwyrite Homestead http://eheritage.metadata.net/record/VIC-69290 viewed March 2017).

14 Flora's collectors included: F. M. Wilson, Mrs Nealy, Mrs Gapes, Mrs Inglis (wife of John Inglis, Tarwin, c.1827–1916), Miss Howard, Mr Sayce, Miss Robinson, C. Bailey, and Alice [Berham].

scientific life of the city, although a number of societies, such as the Royal, were at this time closed to women beyond special occasions (Tyler n.d.).[15] This was a significant disadvantage for autodidacts like Flora who needed contact with more experienced researchers, with whom she could exchange and refine her views. Later she referred to her early mycological efforts as 'very very stupid' (Campbell 1885c), but she proved to be a quick learner.

In 1880, a new society emerged in the Melbourne scene. Open to women from the beginning, the Field Naturalists Club of Victoria (FNCV) had progressive first presidents (Houghton 2005). In 1884, congregational minister the Rev. J. J. Halley (1834–1910) (Gunson 1972), told members that he was convinced of the scientific benefits of inclusiveness, and hoped that, 'before many years have passed, to listen to this annual address delivered by one of the sisterhood of our guild' (Halley 1885: 4).

Flora attended FNCV meetings from June 1883 (Anonymous 1883a), and was voted a member on 9 July (Anonymous 1883b). At her first meeting she exhibited a collection of fungi, and continued to display fungi, lichens, fossils, plants, paintings and other objects at regular intervals (Appendix). After the 1885 annual conversazione, Flora boasted to Broome that the word most often applied to her display of fresh fungi was 'Wonderful'. 'They had never seen the like', she told Broome proudly, and the exhibit 'kept a crowd round it' (Campbell 1885b).

In July 1885, Flora became the first woman to publish an article in the Club's journal, (a list of fungi) (Campbell 1885a, see also 1886, 1887a), and a year later became the first woman to write a talk for the Club, and then to present a talk to the Club.[16] Flora was initially 'shy' about speaking in public, and her first address, 'Notes on edible fungi', was read by the Club secretary, Francis George Allman Barnard (1857–1932). A summary of this presentation in the *Victorian Naturalist* indicates that Flora had adventurous views on fungal edibility. She claimed that ten species common in Victoria and 'usually regarded as poisonous' were, in fact, harmless, 'if eaten when young and fresh'. 'The paper was very interesting,' the *Victorian Naturalist* noted, 'and created some little discussion' (Anonymous 1886b).

At least two Club excursions benefitted from Flora's fungal commentary and identifications.[17] On the Queen's birthday in May 1885, she joined about 25 members and friends on a train to Lilydale (then a separate village on the outskirts of Melbourne). Nearly 100 species of fungi were collected on the day and 'I was the only one who knew the [sic] anything about them', she told Broome (Campbell 1885b). A report of the excursion in the *Victorian Naturalist*, supported this claim noting: 'our mycologist had almost as much as she could do in collecting specimens or packing away those brought to her by other members of the party' (Anonymous 1885: 33; Campbell 1885a).

The Cryptogamic Section

By 1886, there were enough mycologists, lichenologists and bryologists in the FNCV to form their own section within the Club (Anonymous 1886a; May 2005). Flora served the section for a time as honorary secretary (Martin 1892), and exchanged specimens with other members including Felix Reader (1850–1911), a German-born pharmacist; the Rev. Francis Robert Muter Wilson (1832–1903); Melbourne pharmacist Francis G. A. Barnard; and Richard Austin Bastow (1839–1920), a draftsman in the Victorian public service (George 2009). In fact, a number of Flora's surviving specimens at Australian herbaria seem to have been lodged as part of these colleagues' herbaria.[18]

Another keen mycologist in the section was Henry Thomas Tisdall (1836–1905), a schoolteacher who lived and collected for a time in Gippsland (Gardiner 1990; George 2009). Tisdall gave a number of talks on fungi to the Club, but lacked the confidence to draw conclusions about his specimens without reference to expert taxonomists (May 1990: 270). Flora found fault with Tisdall's nomenclature, complaining in 1889 that he interchanged the terms 'spore' and 'seed'. '[W]ill I

15 The first female member of the Royal Society of Victoria, Helen Neild, was elected as an associate member in July 1889 (https://rsv.org.au/wp-content/uploads/historyrsv.pdf viewed 2017).

16 A number of Flora's first talks were not published: 'Notes on edible fungi', March 1886 (presented by Barnard); 'Notes of a trip to Cabbage-tree Creek, East Gippsland', April 1888 (presented by Flora); 'an account of work done in cryptogamic botany during the year' (Anonymous 1890g).

17 Flora went with Club members to Lilydale in May 1885 (Campbell 1885), and to Cheltenham in June 1886 (Anonymous 1886c).

18 Based on searches in 'Australia's virtual herbarium', https://avh.chah.org.au/ viewed March 2017. Reader's herbarium was purchased by the National Herbarium of Victoria about 1906, F. R. M. Wilson's herbarium was purchased by the National Herbarium of Victoria after 1896 (Short 1990: 5–6).

Figure 1. *Cortinarius bovinus* 'Wavy Tisdal [sic]', water colour painting by Flora Martin (RB MSS A50, Library, Royal Botanic Gardens Victoria)

call a chrysalis an egg next', she exclaimed, 'and not be corrected in our club?' (Campbell 1889).[19] She and Tisdall remained colleagues, however, and Flora referenced him in her familiar name 'Wavy Tisdal [sic]' for a species of a locally occurring fungus with a wavy edge on the cap, *Cortinarius bovinus* Fr. (Figure 1).

A very clever man

The 1880s were a time of rapid scientific development for Flora, but rather than attributing this fact to the FNCV, she claimed it was because she had come 'under the care of a very clever man' (Campbell 1888a: 129). Acquiring a mentor was almost a necessity for talented women scientists in the nineteenth century. Georgina King had George Bennett (1804–93), a venerable naturalist in New South Wales (Carter & Cross 2013: 36–37). Male mentors were invaluable in negotiating with scientific circles, which continued to consist mostly of men, and the mentors also conferred a certain measure of authority by association (Maroske 1993, Maroske & May 2018).

Flora's 'clever man' was almost certainly Daniel McAlpine (1849–1932), a lecturer in biology at Ormond College, a Presbyterian residential college at the University of Melbourne. Four years younger than Flora, McAlpine was born and raised in Scotland, matriculated at the University of London in 1873, and attended lectures by leading scientists such as Thomas Huxley (1825–95) and William Thiselton-Dyer (1843–1928). McAlpine established his career in Edinburgh, lecturing at the new Veterinary College and at Heriot-Watt College, and publishing a series of biological atlases (White 1986).

In 1884, McAlpine migrated to Australia with his family. Flora reported attending his lectures in 1885, for which she would have needed the permission of both McAlpine and Ormond College. 'I was delighted with a lecture by Mr D. McAlpine on Lichens', she told Christopher Broome, 'and worked hard at them with the Rev. Mr Wilson', a colleague in the Cryptogamic Section of the FNCV (Campbell 1885b).[20]

By 1886, Flora's friendship with McAlpine had developed to the point where she gave him half her herbarium, 'as I wished to forward his interests here and if I could in any way assist in keeping him in our Colony, it would be good for us' (Campbell 1886b). This was a significant act of generosity, as Flora claimed her collection of fungi was the largest in the southern hemisphere.[21]

19 Felix Reader was also critical of Tisdall's terminology and published a list of corrections to one of his talks in the *Victorian Naturalist* (Tisdall 1886, Anonymous 1886a).

20 Wilson called Flora 'an indefatigable collector of lichens as well as of other plants' (Wilson 1887), and recognised her herbarium in a list of Australian lichen collections (Wilson 1890). See also Ralston (2001). The text book used by Wilson and Flora was Leyton (1871) (see MacDonald 1916).

21 MS annotation by F. Martin on her copy of McAlpine (1895): Library, Royal Botanic Gardens Victoria, Melbourne, Vic., Australia.

The only other likely rival herbarium was that of Ferdinand Mueller, but Flora estimated that his collection of fungi was only a quarter of the size of hers, and 'miserable'. 'I have just been over for the fourth time', she told Broome in 1886, 'and nothing hardly new in it for the last four years' (Campbell 1886b). Mueller, and his collectors, were in fact significant contributors of new fungal taxa, but many of the types remained in institutions overseas, and Mueller did not systematically keep duplicates of fungi (May 1990).

Baron Ferdinand Von Mueller

Although regarded as a generous teacher by many women, including Georgina King (Maroske 2014; Carter and Cross 2013: 79–82), Mueller's relationship with Flora remained poor. One source of tension lay in how she distributed her specimens.

In 1885, Mueller gave a talk on fungi to the Club. Taking the opportunity to outline the best path for mycology in Australia, he remarked:

> *To those not initiated in mycologic studies I would like to point out the desirability of sending Australian fungs [sic] to specialists through any great phytologic institution, so as to avoid clashing of various professional observers' studying similar material (Mueller 1885).*[22]

This methodology also allowed him to keep across botanical developments, and to ensure proper recognition for his own contributions.

As Flora was already communicating with taxonomists overseas, Mueller's admonition stung. To her it seemed to be more about control than communication. As she wrote to Club secretary Francis Barnard: 'The Baron bitterly complains of my daring to send things to Mr Bailey.' Flora thought this was especially unfair as Bailey had told her that Mueller often named or distributed Queensland plants without consulting him. 'I can't write at the moment', she protested to Barnard, 'I am so indignant' (Campbell 1885c).

As Flora developed expertise in mycology, she became increasingly willing to back her own judgement over Mueller's. 'There is a brilliant small Fungus in the Domain, South Yarra', she wrote to a newspaper, described by Cooke and Massee as *Agaricus pulchellus* Cooke & Massee (Cooke 1889a) on the basis of one of her specimens.[23] 'I have reason to think Baron Von Mueller mistook [it] for *Agaricus muscarius*', a European species (Martin 1912) (Figure 2).[24] Mueller's error was understandable, as both fungi have spotted red caps, although in the former the spots are yellow, and in the latter white. *Agaricus muscarius* L. was likely introduced into Australia, but was not confirmed as occurring in Victoria until 1940 (Willis 1940).[25]

Practical mycology

Vegetable pathology

By 1887, Flora's mycological interests had begun to focus on the study of fungi as pathogens, or the discipline of 'vegetable pathology', and she gave a talk on the subject to the FNCV (Campbell 1887b). This was not the kind of natural history that usually occupied the Club's meetings or filled the pages of its journal, and signalled the beginning of Flora's disengagement from the Club. Flora did not abandon the collection and identification of fungi, but she would thereafter spend more of her time studying 'the great economic importance of this group of our plants' (Campbell 1887b: 125).

While it is not clear exactly why Flora began to investigate vegetable pathology (McAlpine may have been an influence), her efforts coincided with a rise in community concern about 'wheat rust'. The pathogen causing this disease was a fungus formally known as *Puccinia graminis* Pers. Rust caused the greatest crop losses sustained by wheat farmers (Parbery 2015). In 1885, the Victorian government established a Royal Commission into Vegetable Products to make recommendations on how to reduce the colony's reliance on wheat, as a means of mitigating the economic impact of wheat rust.

Emboldened by her recent research, and her contacts with international scientists, Flora came forward to give evidence at the Royal Commission. Of the witnesses

22 'For years Mrs Martin and also Mr Bailey have caused me trouble in respect to fungi, which I particularly blame on the latter, since he only was led late in life to botanical collecting through me by correspondence' (Mueller 1890).

23 This Australian species had in fact already been named by Berkeley in 1845 as *Agaricus xanthocephalus* Berk.. It is now known as *Amanita xanthocephala* (Berk.) D.A. Reid & R.N. Hilton (May et al. 2004).

24 Flora repeated this claim in an annotation next to the entry for *Amanitopsis pulchella* (Cooke & Massee) McAlpine on her copy of McAlpine (1895): Library, Royal Botanic Gardens Victoria, Melbourne, Vic., Australia.

25 *Agaricus muscarius* is now known as *Amanita muscaria* (L.) Lam. (May et al. 2004).

examined by the Commissioners, a Mrs S. Simpson, whose specialty was fruit preserving, was the only other woman.

Flora's presentation was competent and engaging, illustrated by fungal samples she picked up in shops on her way as evidence. Arguing that plant disease was often the product of both insect and fungal action, Flora advocated the appointment of a government vegetable pathologist who was an expert in both mycology and entomology (Campbell 1888a). The need for more scientists in the Department of Agriculture was reiterated by other witnesses before the Royal Commission including Ferdinand Mueller (Madden et al. 1888).

Flora gave evidence in January 1888, and the following month toured parts of Victoria, examining

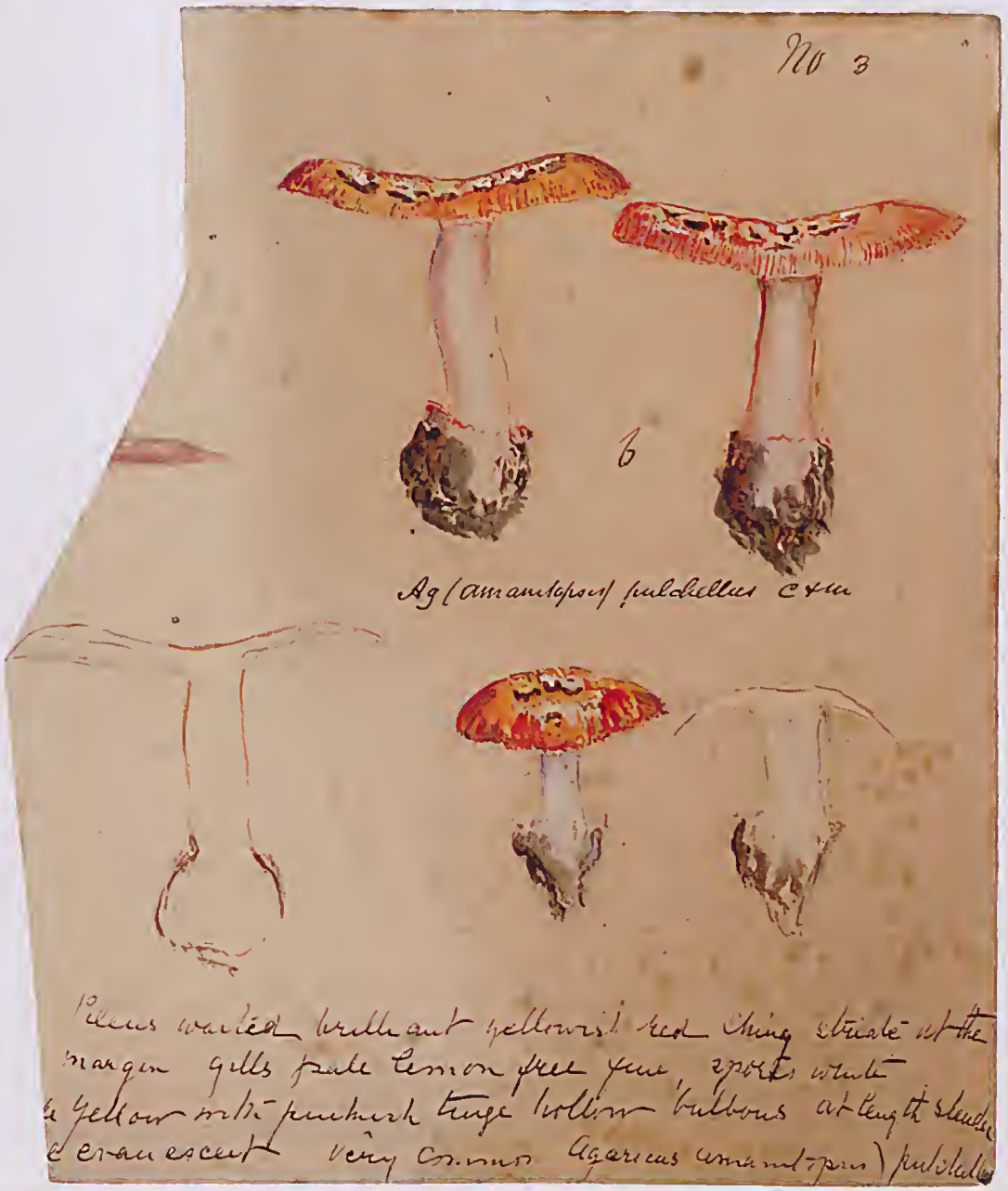


Figure 2. *Agaricus (Aminitopsis) pulchellus*, water colour painting by Flora Martin (RB MSS A52, Library, Royal Botanic Gardens Victoria)

diseased elms at Benalla (Campbell 1888b, Anonymous 1888a), diseased vines at Mooroopna, and pathogens in hop fields, and gardens around Bairnsdale (Anonymous 1888b). Although she does not seem to have been given any remuneration for this excursion, it was made with the imprimatur of the Vegetable Commission and the Victorian Agricultural Chemist, A. N. Pearson (1856–1933) (Jewell 1988). 'If you think you would be able to take up for investigation the habits of the hop 'spider",[26] Pearson wrote to Flora, 'you would probably find it best to go down to Bairnsdale at once' (Pearson 1888).

While in Gippsland, Flora also visited Cabbage Tree Creek, the southern-most occurrence of the Fan Palm, *Livistona australis* (R.Br.) Mart. In this instance, she was acting on behalf of the Minister for Agriculture, John Lamont Dow (1837–1923) (Dow 1972), with a view to have the palms 'placed under protection from destruction' (Anonymous 1888b). On her return to Melbourne, she presented 'an interesting description' of the locality to the FNCV (Anonymous 1888c). The following year the FNCV officially joined in lobbying for the protection of the palms at Cabbage Tree Creek, and as a result they were placed in an expanded reserve (Presland 2016).

Marriage

Busy as she was with fungi, Flora made space in her personal life in 1888 to court and marry widower and building contractor William Martin (c.1830–1909). Little information survives about this relationship, which may have begun in shared Presbyterian circles. Fifteen years older than Flora, William was born in Wishaw, Scotland, to master weaver, Thomas Martin, and Jane née Innes. In 1853, William married Jane Alexander who appears to have died soon after, and he made the voyage to Australia the following year alone.[27]

In Melbourne, William joined John Peacock (c.1830–1905) in establishing 'Messrs Martin and Peacock'. Flora was proud that this firm built a number of Melbourne icons, including the Mint (Anonymous 1870), Government House (Anonymous 1872), St Paul's Cathedral (Anonymous 1879c), 'and far too many buildings to mention' (Martin 1894e). With this work history, William was able to develop a modest portfolio of property and private assets, including a house in the Melbourne bayside suburb of North Brighton (Mueller).[28]

Fungi on vines

Marriage to William Martin did not diminish Flora's commitment to fungi, and she later recalled 1889 as a year in which, 'all my spare time was employed studying the fungus diseases of the vines and their treatment', examining thousands of diseased leaves, and sending many specimens to Europe (Martin 1894a; 1894b, 1894c). Three diseases in particular were the focus of her research; downy mildew, phylloxera, and anthracnose, all scourges of the colonial wine industry.

Unfortunately, few of Flora's findings survive, due to the destruction of records in the Department of Agriculture. In a sequence of letters to Melbourne newspapers, however, she revealed that she was familiar with the most up-to-date information on fungal diseases, and current scientific names. She conducted experiments in her own garden, but was aware that her results needed to be replicated and alternative explanations considered, before she could declare her conclusions to be sound. Taking her lead from current literature, she trialled mixtures of lime and sulphur as fungicides, with the addition of extra ingredients such as bluestone and yellow clay, and consistently reported the production of 'good crops', and enhanced flavours in the produce (Campbell 1888a; Martin 1893; 1894a).

Government scientists

This was exactly the kind of research that Flora, and others, had advocated to the Royal Commission, and indeed its final report recommended the creation of new scientific positions (Madden et al. 1888). Under strong pressure from the agricultural sector to act, the Victorian government appointed Charles French (1842–1933), a former employee of Ferdinand Mueller and active member of the FNCV, as government entomologist in 1889 (Pescott 1981), and Daniel McAlpine, Flora's 'clever

26 Pearson put 'spider' into single inverted commas, because although commonly referred in this way, the organism was in fact an acarid or mite.

27 Death certificate 1909/461, William Martin: Births Deaths Marriages Victoria, Melbourne, Vic., Australia. Victoria, Australia, Assisted and Unassisted Passenger Lists, 1839–1923 (images of original documents, ancestry.com.au viewed March 2017).

28 Probate and administration files, William Martin, VPRS 28/P003, unit 105, item 114/654, Public Record Office Victoria.

man', as vegetable pathologist in 1890, likely the first full-time appointment to a permanent post of its kind in the British Empire (White 1986, Ainsworth 1996).

French lost no time in publishing the first part of a *Handbook of destructive insects of Victoria* (French 1891). The FNCV was delighted with this achievement and at the July meeting the president moved a motion to congratulate French 'on the successful issue of his book'. Flora, however, was not impressed, and took the opportunity to give 'some adverse criticisms' of the work. The *Victorian Naturalist* did not record any details of Flora's remarks, noting only that the president's motion 'was carried with acclamation' (Anonymous 1891a).

Angered by the omission, Flora wrote a letter to the editor of the Melbourne *Argus*, arguing that her comments needed to be published, 'in justice to others working at our fungus plant diseases'. Flora thought French's book failed to acknowledge the important relationship between insects and fungi in plant disease, and she was highly critical of French's imprecision, use of terminology and lack of practical detail (Martin 1891). Moreover, although she did not say so, French had also overlooked her contributions, including her investigations into the 'Red Hop Spider'.

Unexpectedly, Flora's letter caught the attention of satirical newspaper, *Melbourne Punch*. Its gentlemen journalists took great delight in mischaracterising her technical language as 'charming' and 'poetical', and quoted some of Flora's more abstruse terms as humorous examples. 'What captivates us ... about the affair', the satirists proclaimed, 'is that a lady should write in this way. Most of the delicate fancy work of literature has so far been done by men' (Anonymous 1891b).

While Flora was unenthusiastic about French's appointment, she was elated with that of McAlpine, and believed strongly that she had played a significant part in it (see below). Ferdinand Mueller also claimed credit for the appointment. In fact McAlpine's most powerful advocate was probably Alfred Deakin (1856–1919), Chief Secretary of Victoria in 1889 (i.e. the political leader) (Norris 1981; McAlpine 1890; Deakin 1889).

Mueller and Flora were both vital sources of information on Australian fungi for McAlpine. Mycology was part of McAlpine's scientific education in England, but initially his 'interests were broad and his focus on fungi did not sharpen until the late 1880s' (Parbery 2015: 51).[29] In particular, Flora's gift of half her herbarium, and her own experimental work in vegetable pathology were rich resources that McAlpine could deploy.

Australian Association for the Advancement of Science 1890

At the same time as Flora lobbied for McAlpine, she was preparing a paper for the second congress of the Australasian Association for the Advancement of Science (AAAS later ANZAAS). Founded in 1888 on the model of the British Association for the Advancement of Science (MacLeod 1988), the AAAS was another scientific society open to women from the beginning. They made up about 4.5% of the membership at the first congress at Sydney in 1888 (including Georgina King), and increased to 6.5% at the Melbourne congress in 1890 (Liversidge & Etheridge 1889; Spencer 1890).

The week-long congress provided a rich intellectual diet for participants. One such was Allan Campbell (1836–98, no relation of Flora's), a politician from South Australia. He had a particular interest in wheat rust and commented:

> *By dint of not confining my attendance to one section I have been hearing and seeing a good deal. I have been in the sanitary section reading a report; also the social science section, listening and speaking; in the engineering section listening and speaking, and in the biological section listening to bacteria lectures and diseases of plants and speaking too (Campbell 1890).*

The paper on 'Diseases in plants', was, in fact, given by Flora, who thereby became the first woman to submit or present a paper at an AAAS Congress.

Her achievement went largely unremarked in newspapers.[30] The correspondent for the *Sydney Mail and New South Wales Advertiser*, described Flora as 'the first lady to read a paper at the congress' (Anonymous 1890a),[31] although a rival newspaper, the *Sydney Morning Herald*, not only failed to grasp the significance of the event, but also attributed Flora's paper to 'Mr.

29 Parbery (2015: 51–52) suggests Mueller and Cooke as important sources of information about Australian fungi, but does not seem to be aware of Flora's contribution.

30 C. A. Topp, president of the FNCV, noted Flora's achievement in his annual address (Topp 1890: 3).

31 The FNCV also noted Flora's achievement: 'the only paper read by a lady at the association was one on the diseases of plants by Mrs. Martin, so well known to her fellow-members of this Club for her interest in fungology' (Topp 1890).

Figure 3. 'The Baron discourses': possible portrait of Flora Martin (*Illustrated Australian news and musical times* 1 February 1890: pp. 8, 17)

William Martin' (Anonymous 1890b). Unfortunately no copy of Flora's paper survives as it, and a number of others given in the same section, were not published in the AAAS *Report*.

The congress over, Flora Joined a group of 53 (including seven women) on an excursion to the Australian Alps (Anonymous 1890a). The party left on Wednesday 15 January and returned to Melbourne the following Saturday. Reports of the tour were favourable, although most participants regretted the excessive dust and heat, with the temperature rising to 90°F by midday at 5,050 feet on Mount Hotham ([Hurst-Browne] 1890). Several artists and photographers accompanied the excursion and a double-spread of sketches appeared in the *Illustrated Australian News and Musical Times* (Anonymous 1890f).

In lieu of any other portrait of Flora, these sketches may include the only representation of her to survive. Given that there were only seven women in the party, there is a reasonable chance that the woman leaning forward, looking intently at a plant being held up for inspection as 'The Baron discourses' could be Flora (Figure 3).

Cooke, Massee and the *Handbook*

Mordecai Cooke and George Massee

While Daniel McAlpine's appointment as vegetable pathologist heralded a new era of professional mycology in Australia, the description of novel species continued to be dominated by taxonomists overseas. Berkeley retired from active work in the mid 1880s and Broome died in 1886 (English 1987), but they were replaced by another famous English partnership; Mordecai Cooke (1825–1914) a curator at the Kew Herbarium, and George Massee (1845–1917) a public lecturer and assistant at the Natural History Museum.

No correspondence between Cooke or Massee, and Flora has been found, but between 1889 and 1892, the pair published thirteen articles citing her specimens in Cooke's journal, *Grevillea*. Flora claimed that she gave the remaining half of her herbarium to Cooke (Campbell 1886b), and judging from surviving collecting numbers this may have included as many as 1,000 specimens. Cooke and Massee used these to describe 78 new taxa, and identify numerous new records for Australia (Cooke 1889a; 1890a–f; 1891a–e; 1892b).

Although rarely dedicating new taxa to collectors,[32] at Flora's request, Cooke and Massee named a new genus of pored mushrooms after her father, *Campbellia* Cooke & Massee (Cooke 1890d),[33] and also named (of their own volition), a new subgenus of leaf-spotting fungus after her, *Polystigmina* subg. *Martinella* Cooke & Massee (Cooke 1889a: 7; Saccardo 1892: 409).[34] Reports of these taxa were published in Melbourne newspapers, probably forwarded by a delighted Flora. 'It is rather a common occurrence', claimed the *Leader*, 'in Victoria at least, to have one's name associated with a species, but when it is a new genus to which the name is devoted, then the honor is all the greater' (Anonymous 1890c; Anonymous 1890d; Anonymous 1890e).

Like Tisdall, Flora did not suggest any scientific names for her discoveries (except for eponymy), but she did give brief descriptions of the key macroscopic features including spore-print colour, and also recorded details that could only be observed using a hand lens. Flora owned a microscope, but she rarely seems to have recorded information on microscopic characters.[35] Cooke and Massee made make liberal use of her notes, often reproducing parts of them verbatim.[36]

Flora's collections of leaf spots proved to be a particularly rich source of new taxa, but she sent so many to Cooke that he eventually asked her to stop. 'I collected about [250] for Dr Cooke,' Flora recalled later, 'a number of them being determined by him to be new to science. He wished to have these, but wrote at last that he was very tired of working at the 'diseases of the eucalypts" (Martin 1895b). Even today, eucalypts continue to yield high numbers of novel fungi (Cheewangkoon et al. 2009).

Handbook of Australian Fungi

In 1890, Cooke was uncertain if his position at Kew would be renewed (English 1987, Cooke 1889b). Looking for a new source of income, he revived an idea to produce a handbook of Australian fungi. A couple of years earlier Mueller had investigated and rejected the proposal as 'impracticable' (Cooke 1889c; Mueller 1889b), but this time Flora became involved and was enthusiastic. She wrote to all the Australian Secretaries of Agriculture on Cooke's behalf, and he was eventually granted £150 from New South Wales, £50 from South Australia, and £100 each from Victoria, Tasmania, and Queensland (McAlpine & Smith 1891; Cooke 1892a; Anonymous 1892d; Pearson 1890).

Mueller, who may not have known about Flora's actions, credited the grants to McAlpine (Mueller 1891b), and McAlpine's biographer credited them to Mueller (Parbery 2015: 51). Cooke, however, makes Flora's role clear in his Preface where she is mentioned three times. 'My thanks are due', he declared, 'to Mrs. Flora Martin for her unflagging energy in smoothing the way for the accomplishment of this long-cherished design, now brought to a close' (Cooke 1892a).

Cooke's *Handbook of Australian fungi* was published in London by July 1892.[37] Initially well-reviewed in Australia (e.g. Anonymous 1892a; 1892b), it eventually proved frustrating for users. The handbook provided only brief descriptions of taxa, and although the associated illustrations were very fine, they were often made on the basis of imperfect material. This meant that users found

32 'Dr Cooke has alienated several Australian fungi collectors by always refusing to dedicate any species to the collectors and those inspired to collect. Such a request after all the efforts, expense and dangers is surely an excusable ambition' (Mueller 1893).

33 In an annotation on her copy of McAlpine (1895), Flora wrote next to the genus *Campbellia*: 'Named in remembrance of the 8old Pioneer Alex. Campbell, my father. F. M. Martin | The only specimen was found by Robert Sharp[,] Beenak, Victoria | It was a beautifully coloured sp.': Library, Royal 8otanic Gardens Victoria, Melbourne, Vic., Australia. The genus *Campbellia* is now known as *Rodwaya* Syd. & P. Syd. (May et al. 2004).

34 *Martinella* (Cooke & Massee) Sacc. (1892) is preoccupied by *Martinella* Baill. (1888) Bignoniaceae.

35 A surviving collection of Flora's water-colour illustrations contains some details that she may have observed through a microscope (R8 MSS A52, Library, Royal 8otanic Gardens Victoria, Melbourne, Vic., Australia.

36 e.g. *Agaricus (Pholiota) disruptus* Cooke & Massee (now *Pholiota disrupta* (Cooke & Massee) McAlpine) (May et al. 2004). In the notes on her drawing of this species Flora wrote: '613 | Pholiota spores sepia brown or bright yellowish brown or light red | stipe confluent and homogenous with the hymenophore with friable persistent or fugacious ring | Brighton | Turnip bed | Nov 1890 | F M M – | height 3-6 inches | Pileus warted pale mushroom colour sometimes almost smooth on margin, recurved – fleshy – Gills dull dirty pinkish white at length brown free small sinus [–] Stipe long same colour as mushroom bulging above then slender hollow yet firm ragged – bulbous at base much strong mycelium spores brown white veil disappearing' (RB MSS A52, Library, Royal Botanic Gardens Victoria, Melbourne, Vic., Australia). Cooke and Massee's description is: 'Pileus convex, fleshy, creamy white, at first smooth, then cracked deeply into large areolae, especially about the fleshy disc (8–10 c.m. broad), margin incurved. Stem elongated, cylindrical, expanding into the pileus, sometimes slightly swollen at the base (10 c.m. long, 10–15 m.m. thick), same colour as the pileus, hollow, striate, cracking, and subsquamulose, with a strong cord-like mycelium. Ring narrow, pendulous. Gills adnate, rather ventricose, broad, not crowded, dull pinkish white, then umber. Spores elliptical, tawny brown, 14 x 18 u. On the ground. Victoria (Mrs. Martin, 613)' (Cooke 1891b: 89).

37 Flora exhibited a copy at the August 1892 meeting of the FNCV (Anonymous 1892c: 63).

it difficult to identify specimens from the handbook with confidence (May 1990, English 1987).

Flora's opinion of the handbook has not survived, but Cooke sent her a copy enclosing an inscribed photograph: 'In kindly remembrance of the good offices of Mrs. Flora Martin in advancing this work in the colonies, and in securing its official recognition, my thanks are ever due' (Pitcher 1925). Something of an outsider himself, Cooke found no difficulty in acknowledging Flora's contributions as those of an 'enterprising Australian mycologist' (Cooke 1890d: 87).

While Flora was likely satisfied with these tributes, Ferdinand Mueller was less so. Ever sensitive to perceived professional slights, he grumbled that Cooke gave him insufficient credit, 'while amateurs, who communicate directly with Dr Cooke, get infinite praise, so that it looks as if I had neglected altogether this branch of knowledge' (Mueller 1891b). Mueller did not begrudge amateurs acknowledgement, usually being scrupulous in this regard himself. His comments were motivated by a concern that the government could use such remarks to cut funding to Australia's few professional scientists (Mueller 1891b).[38]

Later years

Drouin

Flora struggled with unspecified health problems in her thirties and forties, often taking the mountain air as a rest cure. Seeking a more permanent remedy, in 1892 she and her husband moved to 'Weebar', a farm of about 310 acres at Drouin in Gippsland (Martin 1894e).[39] The couple used most of their land to raise Ayrshire dairy cattle, but also kept fowls and grew oats, and potatoes (Martin 1894d; Anonymous 1898; Anonymous 1904; Anonymous 1912).

In 1895, Flora delivered a final talk to the FNCV on the results of her research at Drouin. Called 'A ramble amongst fertilizers', it argued that weedy or even diseased plants, when properly fermented, could be a boon to farmers in preparing ground for crops or pasture. Flora likened the process to 'putting yeast into bread', resulting in an aerated and nutritious soil (Martin 1895c). Flora's mentor, McAlpine, attended the presentation, and afterwards said that he hoped 'other ladies would follow her example and share in the scientific work of the Club' (Anonymous 1895).

Flora's husband, William, must also have supported Flora's research interests, although there is evidence of tension over them at Drouin. In a letter written at the farm, Flora confessed that she was afraid William would return to contracting, 'if he has not more to occupy his time at 'Weebar'' (Martin 1894e). The letter's recipient was William Henry Archer (1825–1909), government statistician (Close 1969), and Flora asked Archer to use his influence to appoint William a justice of the peace at Drouin. Archer obliged, and a local newspaper duly made the announcement a few weeks later (Anonymous 1894).

Systematic Arrangement of Australian Fungi

Later Flora claimed that she moved to Drouin because country life provided her with myriad opportunities to conduct experiments into vegetable pathology (Martin 1895a). This research appears to have been undertaken in association with Daniel McAlpine and the Department of Agriculture. A letter survives from 1894 signed by Flora as 'Honorary Assistant Vegetable Pathologist' (Martin 1894e), an unprecedented appointment for a woman in Australia.[40]

Unfortunately, lack of surviving records from the Department of Agriculture makes it impossible to investigate the details of Flora's position, although McAlpine appointed at least one other honorary assistant, Gerald Henry Robinson (1873–1961). Unlike Flora, however, Robinson went on to become a full-time paid assistant in 1900 (George 2009; White 1986).

McAlpine proved to be a prolific author as Vegetable Pathologist, issuing hundreds of publications (McAlpine 1910). Early works covered rusts, blights, galls and other pathogens of commercial crops, but none of these mentioned Flora. This is surprising given her

38 Mueller's own position was precarious, being subject to six-month renewal as an officer over the expected retirement age of 60 (Home et al. 2006: 19–22).

39 Pitcher (1925), however, states the move was made 'owing to her husband's retirement there for health and other reasons.'

40 Other early female government scientific appointments include Mary Emma Greayer who was employed as a computer at Adelaide Observatory from 1890, Charlotte Emily Fforde Peel, who was employed as a star measurer, computer and astrographic assistant at Melbourne Observatory from 1898 (Stevenson 2014), and Sarah Hynes who was appointed a botanical assistant at the Technological Museum in Sydney in 1898 (now PowerHouse Museum) (Hooker 2005).

semi-official position, and the fact that McAlpine did reference Robinson, and numerous other contributors of practical information. The oversight, however, may signal, or indeed help to explain, a breach between Flora and McAlpine that occurred in the mid 1890s.

In 1895, McAlpine published his first major book, *Systematic arrangement of Australian fungi*. It was a check-list of all known fungi in Australia with brief diagnoses and notes on state distribution. Universally well-reviewed, the *Systematic arrangement* immediately became a foundational work in Australian mycology (Pascoe 1990).

As soon as it was issued, McAlpine sent an inscribed copy of the book to Flora: 'With D. McAlpine's Compliments'. In a scrawl beneath this acknowledgement, she wrote: 'Essence of Insult'. Given her former praise of McAlpine this remark is shockingly curt (Figure 4).

Flora made a number of pointed annotations on the Preface. Next to McAlpine's praise for her 'indefatigable labours in extending our knowledge of Australian species', Flora repeated claims about the large size of her herbarium. She stated that she was responsible for McAlpine's appointment as Vegetable Pathologist, and claimed priority for public use of the term 'vegetable pathologist' in Victoria.

It is not possible to say if McAlpine's lack of appropriate acknowledgement was solely responsible for the falling-out, but Flora clearly felt underappreciated. In turn, what McAlpine thought of the matter, and when he became aware of it are unknown. The *Systematic arrangement* suggests McAlpine regarded Flora principally as a mycological collector, but he had also praised her research abilities to the FNCV (see above). Elsewhere, McAlpine indicated that he felt equivocal about women as students. In an address to the Melbourne Horticultural College, he acknowledged that women already attended such colleges overseas, but remained doubtful about their ability to move beyond branches 'such as flower-gardening, fruit-preserving and scent-making' (McAlpine 1893).

Polyporus Mylittae Cke & Mass.

The rise and fall of Flora and McAlpine's relationship underlines the importance, and power, of a mentor to a woman attempting to walk beyond traditional pathways. It was his measure of her worth, more than any other that influenced how she was regarded in Australian mycology.

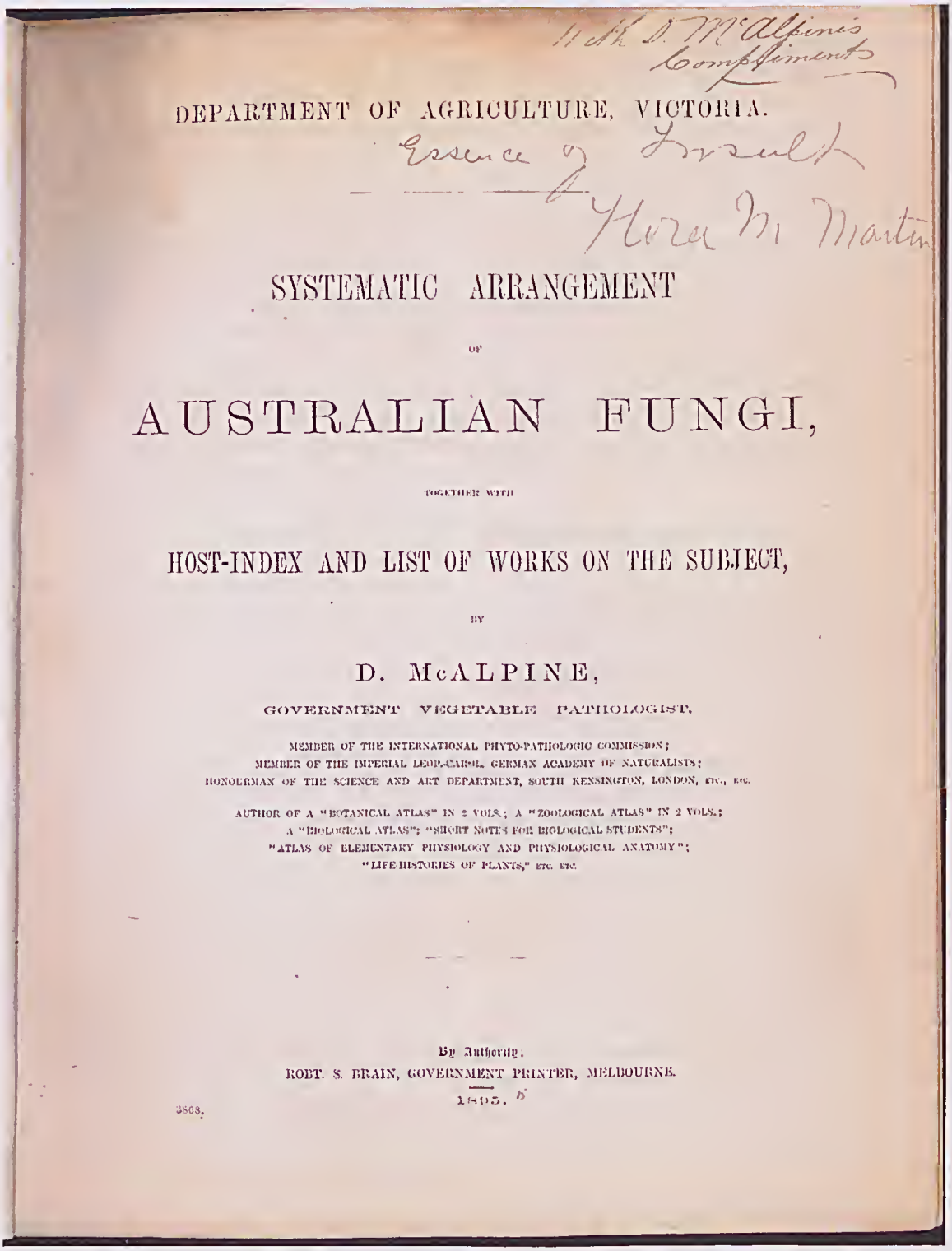
In 1904, McAlpine published an article on the remarkable Australian fungus *Polyporus mylittae* Cooke & Massee, or native bread.[41] The sclerotium (underground growth) of this organism was first sent to the United Kingdom by James Backhouse in in the 1830s, but the fruit body that grew out of it was not observed until 1885 by Henry Tisdall. McAlpine made a list of five known specimens of fructification, curiously omitting one made by Flora, despite having already noted evidence that she sent it to Cooke in 1892 (McAlpine 1904; Barnard 1892). Flora was living at Drouin at the time McAlpine wrote this article and he could have contacted her for clarification.

The Director of Kew Botanic Gardens, William Thiselton-Dyer, read McAlpine's article and wrote to inform him that the type specimen of *Polyporus mylittae* had indeed been collected by Flora Martin, and returned to her 'at her request' (Thiselton-Dyer 1904). Flora's colleague at the FNCV, Francis Barnard, quoted Dyer's letter in the *Victorian Naturalist* in 1923, shortly before Flora's death, to correct the record. Noting that Cooke's type description stated only that the type specimen came from 'S. Australia',[42] he added, 'there is no doubt that it was a specimen sent from Victoria by Mrs. Martin, better known in the early days of the Club as Miss F. M. Campbell, an ardent fungus collector' (Barnard 1923).

Among her annotations on McAlpine's *Systematic arrangement of Australian fungi*, Flora noted next to the entry on *Polyporus Mylittae*: 'The year [1892] I was working hard at the Fungi[.] Plenty in this District Weebar Drouin[.] Specimen sent to Cooke now in Botanical Gardens Melbourne[.]' Unfortunately, the specimen can no longer be located, and from the point of view of posterity Flora would have been wiser to entrust it to Mueller's Herbarium than to the Director of the Melbourne Botanic Garden, William Guilfoyle, (1840–1912), only a few boxes of whose museum specimens survive.

41 Now known as *Laccocephalum mylittae* (Cooke & Massee) Núñez & Ryvarden (May et al. 2004).

42 Barnard actually wrote 'South Australia', but the original text in Cooke's type description was 'S. Australia', and may well have meant 'Southern Australia'. The specimens cited before and after *Polyporus mylittae* were both attributed to Flora (Cooke 1892b: 37).



With D. McAlpine's Compliments

DEPARTMENT OF AGRICULTURE, VICTORIA.

Essence of Insult

Flora M Martin

SYSTEMATIC ARRANGEMENT

OF

AUSTRALIAN FUNGI,

TOGETHER WITH

HOST-INDEX AND LIST OF WORKS ON THE SUBJECT,

BY

D. McALPINE,

GOVERNMENT VEGETABLE PATHOLOGIST,

MEMBER OF THE INTERNATIONAL PHYTO-PATHOLOGIC COMMISSION;
MEMBER OF THE IMPERIAL LEOP.-CAROL. GERMAN ACADEMY OF NATURALISTS;
HONOURMAN OF THE SCIENCE AND ART DEPARTMENT, SOUTH KENSINGTON, LONDON, ETC., ETC.

AUTHOR OF A "BOTANICAL ATLAS" IN 2 VOLS.; A "ZOOLOGICAL ATLAS" IN 2 VOLS.;
A "BIOLOGICAL ATLAS"; "SHORT NOTES FOR BIOLOGICAL STUDENTS";
"ATLAS OF ELEMENTARY PHYSIOLOGY AND PHYSIOLOGICAL ANATOMY";
"LIFE-HISTORIES OF PLANTS," ETC. ETC.

By Authority:
ROBT. S. BRAIN, GOVERNMENT PRINTER, MELBOURNE.
1895.

3868.

Figure 4. 'Essence of insult': Flora's copy of D. McAlpine (1895). *Systematic arrangement of Australian fungi* (Library, Royal Botanic Gardens Victoria)

Legacy

As in the first decades of her life, Flora almost disappears from the historical record in her last decades. She remained at Drouin after her husband's death in 1909, writing a few letters to newspapers (1912; 1917a; 1917b), notably to Donald MacDonald (1859–1932), a nature writer with the *Argus* (Anderson 1986, e.g. MacDonald 1915, MacDonald 1916). With age and isolation she seems to have been effectively shut out of the mycological circles in Melbourne that had so occupied her in the previous century.

After her death on 13 March 1923, her will made clear that mycology, and her contributions to it, had always been uppermost in her mind. To 'the Master for the time being of Ormond College' (the institution where she had attended McAlpine's lectures) she left:

> *all my collections of botanical bacteriological and other scientific specimens and all my fittings instruments*[43] *and appliances in connection therewith and all my books and my book cases ... and I desire that as many of such chattels are suitable therefor shall be placed in the McFarland library at Ormond College ... (Martin 1923).*

This generosity was of sufficient interest to be noticed by Melbourne newspapers (Anonymous 1924), although probate records indicate that it was only partially enacted. Presumably at the request of the College, certain of Flora's books, bookcases and 'etc.' were sold, and the proceeds of £11-10-0 forwarded to the Master.[44]

There is no mention of Flora's specimens in probate records, and according to FNCV member Frederick Pitcher, 'but for the kind offices of a relative of mine, who owned the property adjoining Mrs. Martin's farm', numerous books along with 'numberless botanical specimens, sketches, coloured plates and drawings of fungi' might have been 'destroyed as valueless, after the disposal of other property'. Pitcher put 'a large number of them together, in case they might be of service to the Agricultural Department or members of the Club' (Pitcher 1925). A few of these items are now at the Royal Botanic Gardens Victoria, but the fate of the rest remains unknown.

Conclusion

A talented, middle-class, colonial woman with sufficient leisure to pursue her own interests, Flora Martin née Campbell found purpose and meaning in the study of Australian fungi. Over four decades she laboured to make a significant contribution to mycology despite the restrictions of a gendered and hierarchical scientific system. She collected, illustrated and annotated type specimens of at least 83 new taxa (Maroske & Vaughan 2014), thereby accumulating a significant herbarium. She undertook original research into vegetable pathology, and communicated her results in letters and articles, as a witness to a royal commission, and at a conference of the AAAS.

While unable to advance her own career beyond honorary positions, Flora played a role in the appointment of the first government vegetable pathologist in Victoria, and in the issue of the first fungal flora of Australia (Cooke 1892a). She benefitted from engagement with male colleagues in Australia and overseas, and established her own network of collectors, but was most connected to Daniel McAlpine. He allowed her to attend his classes, and to contribute material and observations to his research, but only acknowledged her work as a collector in his publications.

Flora's life and work personalises the story of colonial women who aspired to make science their vocation but could not quite overcome the barriers in their way. Her frustration with this situation is evidenced in criticisms of colleagues in letters and annotations. Even leaving a record of her achievements proved to be a struggle with Ormond College declining a bequest of materials made in her will. Appropriate recognition from key peers may have been withheld from Flora during her lifetime, but there is enough surviving information about her life and work to establish that she not only made a significant contribution to Australian mycology, but also achieved a suite of firsts for a woman in Australian science.

43 Probate records indicate that Flora's instruments included a microscope from her Drouin property.

44 Probate jurisdiction, Flora Mary Martin, 7 March 1924, Public Record Office, Victoria, Australia.

Acknowledgements

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Appendix: Flora Martin née Campbell's exhibits at the FNCV

SSR = *Southern Science record*, VN = *Victorian Naturalist*

No.	Date	Exhibit	Reference
1	9.7.1883	FNCV meeting: "a collection of Fungi, mostly named"	SSR 3(7) 1883: 181
2	10.3.1884	FNCV meeting: "a rare, if not new species of Fungus of the genus *Tulostemo* [sic] from Sorrento"	VN 1(3) 1884: 17
3	17.3.1884	FNCV at Intercolonial Exhibition: "Collection of Australian Fungi"	VN 1(S) 1884: 35
4	29.4.1885	FNCV 5th conversazione: "a collection of fresh fungi"	VN 2(1) 1885: 15
5	10.6.1885	FNCV meeting: "fern new to Victoria, *Polypodium phymotodes*, from East Gippsland, eight dried Victorian ferns including *Botrychium ternatum*, *B. lunorio*, *Asplenium nidus*, *A. flaccidum*, *Polypodium phymatodes*, and *P. serpens*, new lichens *Usnea retipora* (Knight) Victoria, and *Parmelio Campbellii*, (Knight) New South Wales, also rough drawings of fungi obtained during Lilydale excursion"	VN 2(3) 1885: 29
6	14.9.1885	FNCV meeting: "100 species of Australian lichens"	VN 2(6) 1885: 66
7	12.10.1885	FNCV wildflower exhibition: "Smaller but interesting exhibits"	VN 2(7) 1885: 82
8	14.12.1885	FNCV meeting: "five kinds of fossil wood from Glenmaggie, Gippsland"	VN 2(9) 1885: 106
9	8.2.1886	FNCV meeting: "collection of about 350 species of Victorian fungi, dried and mounted, twenty of them being hitherto unrecorded for Victoria"	VN 2(11) 1886: 126
10	8.3.1886	FNCV meeting: "Victorian fungi in illustration of her paper"	VN 2(12) 1886: 150
11	20.4.1886	FNCV 6th conversazione: "fine specimens of fossil woods from Glenmaggie, Gippsland. A large collection of Australian lichens. Books containing veneers of 350 Australian and 100 Japanese woods"	VN 3(1) 1886: 10
12	14.6.1886	FNCV meeting: "fungi, mosses, and lichens, collected during the Club excursion at Lilydale"	VN 3(3) 1886: 26
13	9.7.1886	FNCV meeting: "specimens of an injurious grass (*Sporobolus indicus*), from the Domain, South Yarra"	VN 3(S) 1886: S4
14	11.10.1886	FNCV wildflower exhibition: "contributed to the general display"	VN 3(12) 1886: 83

No.	Date	Exhibit	Reference
15	14.3.1887	FNCV meeting: "Victorian fungi, *Podoxon pistilloris* and *Xylopodium Austrole*, also plant of *Euphorbio Drummondii*, with particulars of the drug lately obtained from it"	VN 3(12) 1887: 162
16	4.4.1887	FNCV meeting: "*Meloleuco nodosa*, from the Whipstick, Bendigo, also *Lecedea* [sic] *Victorioe*, *Nephromium sub-loevigotum*, and *Ramolino miniusculo*, unrecorded Victorian lichens"	VN 4(1) 1887: 2 [as '174']
17	28.4.1887	FNCV 7th conversazione: "A comprehensive collection of Victorian fungi; an extensive series of specimens of fruits, vegetables, and indigenous plants attacked by micro-fungi, illustrative of vegetable pathology; water-colour drawings of fungi"	VN 4(2) 1887: 29
18	9.5.1887	FNCV meeting: "water-colour drawings of Victorian fungi; also a copy of "Plants injurious to Stock," by F. M. Bailey, F.L.S., Brisbane"	VN 4(3) 1887: 34
19	11.7.1887	FNCV meeting: "a large number of lichens mounted and named"	VN 4(4) 1887: 50
20	8.8.1887	FNCV meeting: "paintings of Tasmanian fungi"	VN 4(5) 1887: 67
21	12.9.1887	FNCV meeting: "fossil plant, *Cinnamomum polymorphoides*, M'Coy, from Cobungra; also thirty fungi unrecorded for Victoria"	VN 4(6) 1887: 82
22	10.10.1887	FNCV meeting: "400 specimens of diseased plants"	VN 4(7) 1887: 99
23	10.10.1887	FNCV wildflower exhibition: "a basket of flowers from various localities"	VN 4(7) 1887: 100
24	9.7.1888	FNCV meeting: "forty rare Australian mosses"	VN 5(4) 1888: 50–51.
25	16.5.1889	FNCV 9th conversazione: "Sixty species of Victorian mosses (including eight new to science)"	VN 6(3) 1889: 53
26	12.8.1889	FNCV annual meeting: "Drawings of 200 species of Victorian Fungi, including eleven new to science"	VN 6(5) 1889: 77
27	14.10.1889	FNCV meeting: "A striking decorative arrangement of native flowers, mosses, &c"	VN 6(7) 1889: 107
28	28.5.1891	FNCV 10th conversazione: "Drawings of some Fungus Diseases of Economic Plants"	VN 8(4) 1891: 63
29	11.7.1892	FNCV meeting: "*Heliophyllum yassense* (Eth. N. Sp.)"	VN 9(4) 1892: 50
30	8.8.1892	FNCV meeting: "The Fungi of Australia," by Dr. M. C. Cooke; "One Hundred and Ninety Lithograms of Ferns of Queensland," by Mr. F. M. Bailey"	VN 9(5) 1892: 63
31	10.10.1892	FNCV wildflower exhibition	VN 9(7) 1892: 98
32	12.6.1893	FNCV natural history specimens: "Giant Earthworm, from Weeba, Drouin; also, new book, "A Companion for the Queensland Student of Plant Life," by F. M. Bailey, F.L.S."	VN 10(3) 1893: 45
33	9.10.1893	FNCV wildflower exhibition: "good displays"	VN 10(7) 1893: 102
34	14-15.6.1894	FNCV 11th conversazione: "Two Giant Earthworms, from Drouin, 7 ft. 2 in. and 7 ft. 6 in. respectively (measured length)."	VN 11(3) 1894: 53
35	8.4.1895	FNCV meeting: "Two extra large old shells (*Corns cornuto*)."	VN 12(1) 1895: 4

Muelleria

36: 74–80

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ROYAL BOTANIC GARDENS VICTORIA

Pannaria hookeri (lichenised Ascomycetes) – a remarkable new record for Australia

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Abstract

Pannaria hookeri (Borrer ex Sm.) Nyl., a bipolar lichen, is recorded for the first time for Australia (south-west Tasmania) where it grew on alpine limestone outcrops. Its identity was confirmed by morphological, anatomical and DNA-sequence data.

Keywords: biodiversity, lichens, species discovery, Tasmania

Introduction

Additions to the list of lichens recorded for Australia are made almost continuously, as demonstrated very well by McCarthy (2017), whose checklist for Australia requires regular updates. It is no exaggeration to observe that, in Australia, a survey of almost any area, or a revision of any taxonomic group, will reveal previously overlooked novelties. The Bush Blitz Programme, conducted by the Australian Biological Resources Study since 2010, has been especially successful in this regard. This paper reports a particularly interesting discovery, *Pannaria hookeri* (Borrer ex Sm.) Nyl., a first record for Australia. This bipolar species is widespread in arctic-alpine areas of the Northern Hemisphere (Jørgensen 1978; Thomson 1984) with scattered occurrences in the Antarctic (Øvstedal & Lewis Smith 2001), Mt Kenya in Africa (Jørgensen 2007), southern South America (Jørgensen 1978) and New Zealand (Galloway 1985). It was discovered in south-western Tasmania during a Bush Blitz Expedition in 2016.

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Methods

Morphology, anatomy and chemistry

Morphological and anatomical investigations were undertaken on material collected in Tasmania and compared with reference herbarium material of *P. hookeri* as listed. Hand-cut sections were mounted in water, 10% KOH, 50% HNO_3 and Lactophenol Cotton Blue. Ascospore measurements are based on 75 observations and are presented in the format: least value–*average*–highest value; outlying values are given in brackets. Routine chemical analyses by thin-layer chromatography follow standard methods (Orange et al. 2001).

Selected comparative specimens examined: **SWEDEN.** Torne Lappmark, Jukkasjärvi par., along river Loktajohka, c. 14 km ESE of Riksgränsen, 4.vii.2015. M. Westberg VAR 192 (S); Lycksele Lappmark: par. Tärna, Rivovardo, 800-1000 m alt., 1924, A.H. Magnusson 7922 (S). **NORWAY.** Opland: Nord-Fron hd, Sikilsdalshö, c. 1620 m. 1620 m alt., 6.ix.1949, S. Ahlner (S). **AUSTRIA.** Nordtirol, Kluppescharte, 1960, H. Doppelbaur & J. Poelt (Lichenes Alpium 141) (MEL 1017675, S).

DNA extraction, amplification and sequencing

Part of the specimen GK102/16 was sampled for DNA extraction using a clean pair of tweezers. The sampled material was transferred to an Eppendorf tube and the DNA extracted using a DNeasy® Plant Mini Kit (Qiagen, Hilden, Germany). The manufacturer's protocol was modified as follows: the material was ground in AP1 buffer using a sterile plastic pestle and then incubated with RNase A for an hour at 70°C. The lengths of all centrifuge steps were doubled and the DNA was recovered in 50 µl of AE buffer.

Two gene regions were amplified: the region including the 5.8S subunit of the nuclear ribosomal RNA gene and the internal transcribed spacers 1 and 2 (ITS) and the small subunit of the mitochondrial ribosomal RNA gene (mtSSU). The primers used were ITS1F (Gardes & Bruns 1993) and ITS4 (White et al. 1990) for ITS and mtSSU1 and mtSSU3R (Zoller et al. 1999) for mtSSU. DNA extracts were checked with a gel electrophoresis and for each sample the band intensity was used to choose the appropriate genomic DNA dilution for amplification. One micro-litre (µl) of a 1, 1/10, or 1/100 dilution of genomic DNA was added to the following PCR mix: 2.5 µl PCR buffer 10 × NH_4 (Bioline, London, U. K.), 1.5 µl of $MgCl_2$ (50 mM), 0.5 µl dNTP (100 mM), 2.5 µl of BSA (10 mg/ml), 1 µl of each primer (10 µM), 0.25 µl DNA polymerase Bioline BioTaq (5 U μl^{-1}), and water to a total volume of 25 µl. The PCR reactions were performed on a C1000 Touch thermal cycler (Bio-Rad, Hercules, CA, USA). The PCR program for ITS was as follow: 5 min at 94°C, followed by 35 cycles of the three steps 1 min at 94°C (denaturation), 1 min at 53°C (annealing), 2 min at 72°C (extension), and a final extension time of 10 min at 72°C. For mtSSU, the program was: 3 min at 94°C, followed by 35 cycles of the three steps 1 min at 94°C, 1 min at 52°C, 1.5 min at 72°C, and a final extension time of 7 min at 72°C. Cloning was conducted on PCR products using a TOPO-TA Cloning kit (Invitrogen, Carlsbad, California), as instructed by the manufacturer. PCR product clean-up and sequencing were carried out by Macrogen (Seoul, South Korea) using BigDye chemistry and an ABI 3730xl sequencer (Applied Biosystems, Carlsbad, California).

Phylogenetic analysis

New *Pannaria* sequences were edited using Sequencher v. 5.4.1 (Gene Codes Corporation, Ann Arbor, Michigan, USA). Published ITS and mtSSU *Pannaria* sequences were obtained from GenBank (https://www.ncbi.nlm.nih.gov/) and manual alignments of all sequences were done using Mesquite v. 3.04 (Maddison & Maddison 2011). The final alignments included 24 ingroup taxa from the genus *Pannaria* and three outgroup species (*Psoroma implexum*, *Staurolemma oculatum* and *S. omphalarioides*) were chosen, based on a previous phylogenetic study (Ekman et al. 2014). Taxon and gene sampling are shown in Table 1. Ambiguous regions were delimited as described in Lutzoni et al. (2000) and were excluded from the phylogenetic analyses. To test for congruence, each locus (ITS and mtSSU) was first subjected to a bootstrap analysis separately using maximum likelihood (ML) (RAxML VI-HPC v.8.2.9; Stamatakis et al. 2005, 2008), as implemented on the CIPRES Web Portal (http://www.phylo.org; Miller et al. 2010). A GTRCAT model was applied to the two markers. Support values were obtained using a fast bootstrap analysis of 1,000 pseudoreplicates. Resulting topologies

were compared for a potential conflict among loci using a 70% reciprocal bootstrap criterion (Mason-Gamer & Kellogg 1996). Because no conflict was detected, the two gene regions were concatenated and the combined dataset analysed using RAxML as described above. Trees were visualized in PAUP* (Swofford 2002) and edited with Illustrator (Adobe Systems, San Jose, CA, USA). The dataset was deposited in TreeBase (22176).

Results

Phylogenetic results

The dataset included 27 taxa (24 ingroup and 3 outgroup taxa) and 1,114 characters (385 from ITS and 729 from mtSSU). The concatenated alignment had 228 distinct alignment patterns and a proportion of gaps and completely undetermined characters of 21.70%. The most likely tree is presented in Figure 1 with bootstrap support values. As in Ekman et al. (2014),

Table 1. Taxon and gene sampling for the phylogenetic analysis. Missing sequences are indicated by a dash. The accession numbers of the two newly generated sequences are highlighted in bold.

	Species	Voucher	ITS	mtSSU
1	*Pannaria andina*	Elvebakk 06-245	GQ927268	-
2	*Pannaria athraaphylla*	Passo 181	EU885295	EU885317
3	*Pannaria athraaphylla*	Passo 251	EU885303	EU885325
4	*Pannaria calaphylla*	Passo 101	EU885296	EU885318
5	*Pannaria canaplea*	Ekman 3188	AF429281	-
6	*Pannaria cantarta*	Passo 142	EU885297	EU885319
7	*Pannaria farinasa*	Passo 119	EU885299	EU885321
8	*Pannaria haakeri*	Jørgensen s.n.	AF429282	KC608083
9	*Pannaria haakeri*	GK102/16	**MG786563**	**MG792317**
10	*Pannaria immixta*	Elvebakk 02-352b	-	KC608084
11	*Pannaria insularis*	Kashiwadani 43760	KC618716	KC608085
12	*Pannaria leucasticta*	Hur 041227	EU266107	-
13	*Pannaria lurida subsp. lurida*	Kashiwadani 43861	-	KC608086
14	*Pannaria lurida subsp. russellii*	Tønsberg 22565	-	KC608087
15	*Pannaria micraphyllizans*	Passo 264	EU885300	EU885322
16	*Pannaria multifida*	Schumm & Frahm s.n.	KC618717	KC608088
17	*Pannaria pallida*	Passo 249	EU885301	EU885323
18	*Pannaria rubiginella*	Tønsberg 32508	KC618718	KC608089
19	*Pannaria rubiginella*	Thor 10050	-	GQ259037
20	*Pannaria rubiginasa*	Ananby 870/Purvis s.n.	AF429280	AY340513
21	*Pannaria sphinctrina*	Passo 221	EU885302	EU885324
22	*Pannaria subfusca*	Tønsberg 33592	KC618719	-
23	*Pannaria tavaresii*	Schumm s.n.	KC618720	-
24	*Pannaria tavaresii*	Passo 122	EU885294	EU885316
25	*Psarama implexum*	Passo 84	-	EU885333
26	*Stauralemma aculatum*	Aptraat 55941	KC618738	GQ259045
27	*Stauralemma amphalariaides*	Tibell s.n.	KJ533487	KJ533439

the genus *Pannaria* is supported as monophyletic (82% bootstrap support). The specimen of *Pannaria* collected in Tasmania (GK102/16) is highly supported as sister taxon to *Pannaria hookeri* (99% bootstrap support). The relatively short branch lengths between the Tasmanian and Northern Hemisphere specimens agree with their conspecific nature.

Taxonomy

***Pannaria hookeri* (Borrer ex Sm.) Nyl.,** *Mém. Soc. Natn. Sci. Nat. Cherbourg* **5: 109 (1858)**

Lichen hookeri Borrer ex Sm., in J.E. Smith & J. Sowerby, *Engl. Bot.* 32: 2283 (1811).

Type: SCOTLAND. Ben Lawers and Meall Greigh, *W. Borrer* (lectotype, *fide* Jørgensen 1978: BM!).

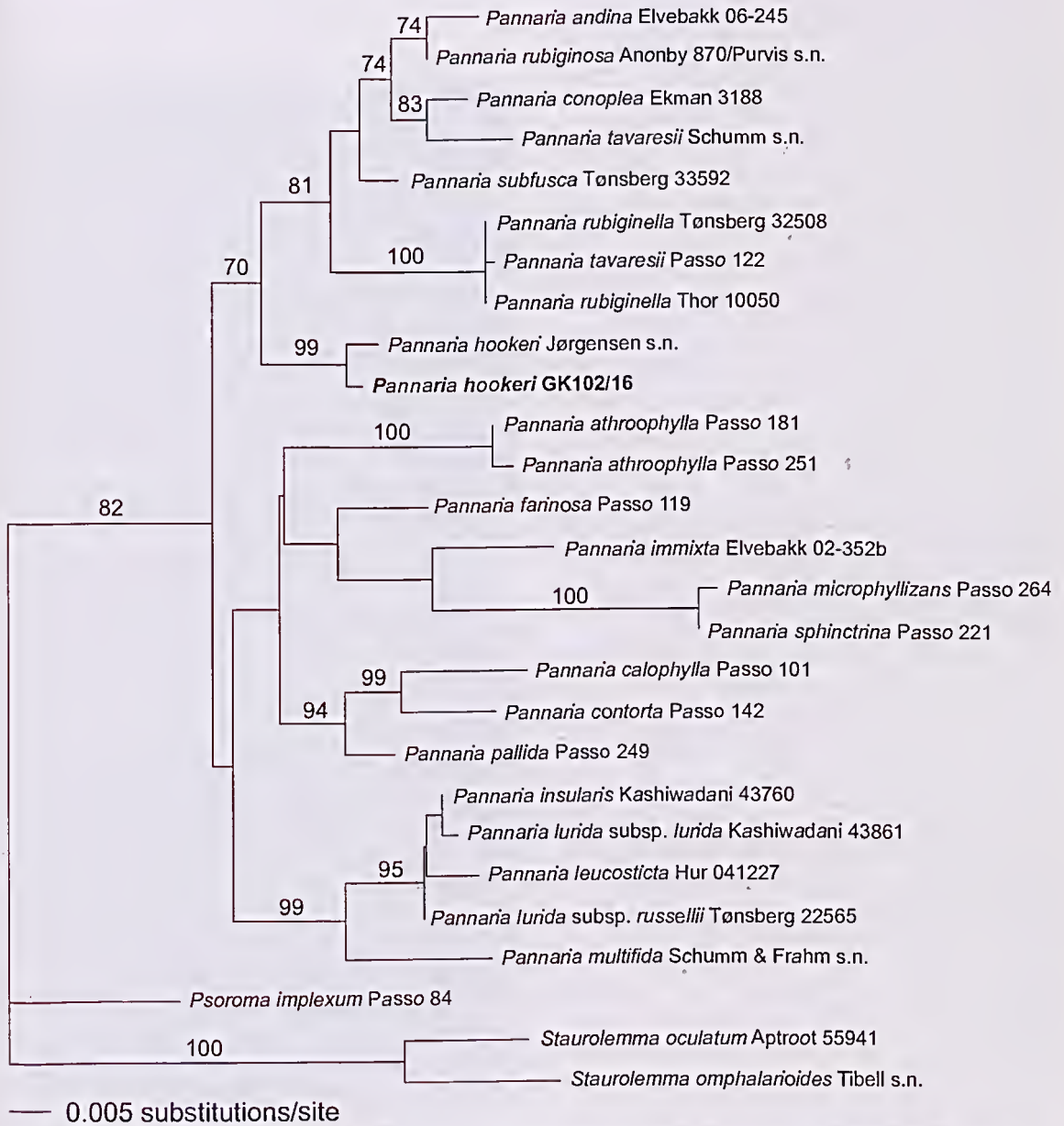

Figure 1. Most likely tree showing the phylogenetic placement of the Tasmanian *Pannaria* specimen (GK102/16). The phylogeny was obtained using a combined ITS-mtSSU dataset and analysed with maximum likelihood using RAxML. Bootstrap support values are reported above the branches. The scale bar represents the number of nucleotide substitutions/site.

Thallus subcrustose to squamulose; squamules plane to convex, sometimes rather gnarled, 0.3–1 mm wide, 250–500 µm thick, dispersed or clustered and overlapping, tightly adnate or loosely attached over a black, effuse prothallus, irregularly rhomboidal and delimited by deep cracks in the centre of the thallus, ± effigurate and spathulate at the margins; upper surface pale brownish grey to smoky bluish grey, ± scabrid-maculate and faintly whitish striate, especially at the thallus margins; photobiont *Nostoc*, comprising single, roundish cells, 5–10 µm wide. *Apothecia* lecanorine, 0.4–1.3 mm diam., scattered, basally constricted when mature; disc dark brown to black, mostly plane but becoming convex and puckered with age; thalline margin mostly entire, crenulate, somewhat inrolled, in section 80–150 µm thick; proper margin prosplectenchymatous, highly reduced to a dark brown band c. 10–20 µm wide between the hymenium and the thalline margin. *Hypothecium* colourless to pale yellowish, lacking photobiont cells. *Hymenium* (65–)70–90(–120) µm thick, colourless, I+ brown, K/I+ blue, overlain by an epithecial band of blue-green pigment, K+ intensifying greenish, N+ crimson. *Paraphyses* simple, 1.5–2.5 µm thick, with the terminal cell frequently enlarged to 4–5 µm and internally blue-green pigmented. *Asci* 8-spored but usually with a few ascospores deformed or aborted, (50–)55–65 x 14–20 µm, clavate, with a well developed, non-amyloid or very weakly amyloid tholus lacking any internal discernible structures, and an intensely amyloid, thin outer sheath. *Ascospores* broadly ellipsoid to ovate, smooth-walled, (10–)12–*14.0*–16(–18) x 6–*7.6*–9(–10) µm, when young with a distinct wall c. 1 µm thick and a large vacuole. *Pycnidia* not found. *Chemistry:* traces of pannarin sometimes found by t.l.c. but not detectable by spot tests. Figs 2–3.

Specimen examined: **TASMANIA.** North East Ridge of Mt Anne, at the western rim of Annakanada sinkhole, 42°55'57" 146°26'29"E, 1050 m alt., on sheltered limestone outcrops, 5.ii.2016, G. Kantvilas 102/16 (HO).

Discussion

The above description is based solely on Tasmanian material but compares favourably with published descriptions (e.g. Jørgensen 1978; Thomson 1984; Galloway 1985; Stenroos et al. 2016), and with reference herbarium material. Further confirmation of our determination was provided by molecular data.

Together with three other species that have highly restricted, circum-Antarctic distributions, *Pannaria hookeri* was placed in the subgenus *Chryopannaria* (Jørgensen 2000). However, subsequent phylogenetic research (Ekman & Jørgensen 2002; Ekman et al. 2014) did not support this classification and simply places *P. hookeri* within *Pannaria* s. str.

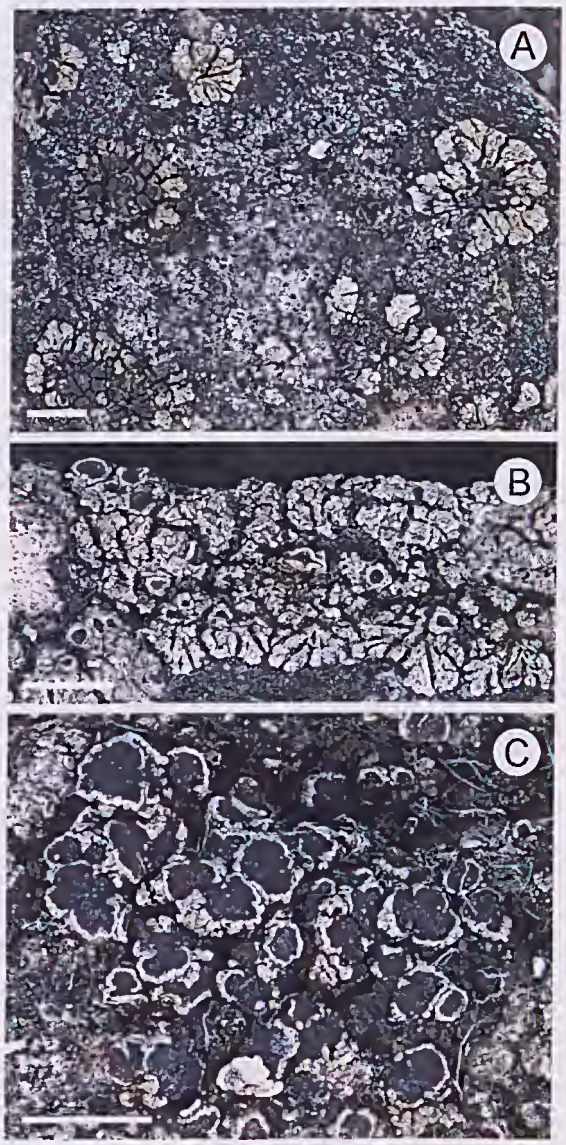

Figure 2. Morphology of *Pannaria hookeri* (GK 102/16). **A.** Habit; **B.** Detail of effigurate squamules with maculate, striate margins; **C.** Detail of apothecia. Scale = 2 mm

Lichens may be notoriously widespread, displaying cosmopolitan, bipolar, pan-temperate and pan-tropical distribution patterns, as well as having more localised ranges. However, applying names across wide geographic areas carries some risks, and there are numerous instances where a species perceived to be the same in both hemispheres has been subsequently found to comprise two distinct entities. For example, Australasian populations of what was once referred to as *Menegazzia terebrata* (Hoffm.) A.Massal. are now called *M. subpertusa* P.James & D.J.Galloway, and the lichen once called *Parmelia omphalodes* (L.) Ach. in Australasia is now correctly called *Notoparmelia signifera* (Nyl.) A.Crespo, Ferencova & Divakar. In this context, Robert Brown's list of lichens native to both Australia and Europe (Brown 1814) makes interesting reading.

In the case of *Pannaria hookeri*, the molecular investigation was critical. When first observed in the field and collected (by GK), the species was immediately recognised as truly novel for Tasmania. However, initial misinterpretation of some ambiguous apothecial characters led to assumptions that it was new to science and of uncertain generic affinity. It was the molecular investigation, essentially to explore its generic relationships within the Pannariaceae, which redirected us towards *P. hookeri* and to making the necessary anatomical and morphological comparisons to confirm our identification.

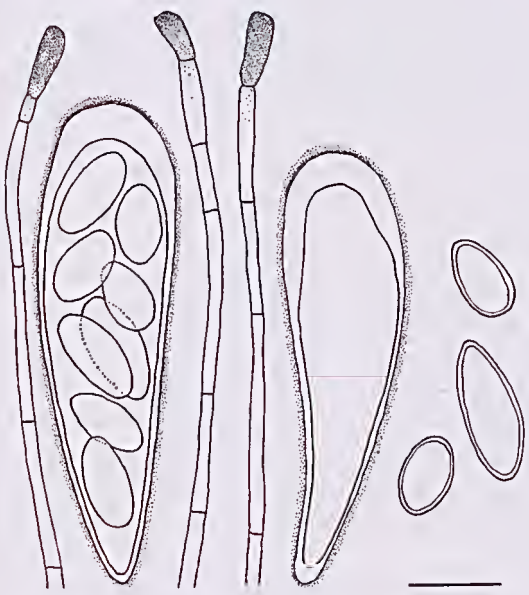

Figure 3. Anatomy of *Pannaria hookeri* (GK 102/16). Asci (amyloid parts stippled), paraphyses and ascospores. Note the typical *Pannaria*-type ascus with a well developed, non-amyloid tholus that lacks internal differentiation. Scale = 10 µm

Ecology and distribution

The ecology of *Pannaria hookeri* is indeed unusual, for it occurs on alpine limestone, an extremely uncommon habitat in Tasmania. Interestingly, several European authors (e.g. Jørgensen 2000; Stenroos et al. 2016; James & Purvis 2009) likewise note its predilection for calcareous substrata. The species was part of a highly depauperate community on relatively sheltered aspects where lichens were patchy and extensive areas of bare rock prevailed. Other lichens recorded included *Baeomyces heteromorphus* Nyl. ex C.Bab. & Mitt., *Catillaria lenticularis* (Ach.) Th.Fr., *Lepraria vouauxii* (Hue) R.C.Harris, *Paraporpidia leptocarpa* (C.Bab. & Mitt.) Rambold & Hertel, *Placopsis brevilobata* (Zahlbr.) I.M.Lamb, *P. subcribellans* (I.M.Lamb) D.J.Galloway, *Porpidia crustulata* (Ach.) Hertel & Knoph, *P. umbonifera* (Müll.Arg.) Rambold, *Rhizocarpon petraeum* (Wulfen) A.Massal., *R. reductum* Th.Fr.,. *Staurothele succedens* (Rehm ex Arnold) Arnold, *Stereocaulon ramulosum* (Sw.) Räusch. and a putative new species of *Trapelia* M.Choisy. Several of these taxa are themselves new or interesting records for Tasmania.

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Two new subspecific taxa within the *Eucalyptus* Series *Argyrophyllae* for Victoria

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Introduction

The *Eucalyptus* series *Argyrophyllae* Blakeley includes a small number of taxa which share the following features: the habit of a smallish tree; bark that is stringy (outer bark weathered and grey over inner bark reddish brown); juvenile leaves that, for numerous pairs, are opposite, sessile, amplexicaul, glaucous, initially orbicular, emarginate and eventually cordate or ovate; inflorescences that are simple axillary and 3–7-flowered; buds that are ovoid to diamond-shaped and pruinose; and fruits that are obconical, campanulate or sub-cylindrical with a level or an ascending disc.

As well as *E. cinerea* F. Muell. ex Benth., *E. nova-anglica* H. Deane & Maiden and *E. cephalocarpa* Blakely, recently published taxa include *E. triplex* L.A.S. Johnson & K.D. Hill, *E. conspicua* L.A.S. Johnson & K.D. Hill, *E. alligatrix* L.A.S. Johnson & K.D. Hill, *E. alligatrix* subsp. *limaensis* Brooker, A.V. Slee & J.D. Briggs and *E. alligatrix* subsp. *miscella* Brooker, A.V. Slee & J.D. Briggs. *Eucalyptus triplex* was reassessed to *E. cinerea* subsp. *triplex* (L.A.S. Johnson & K.D. Hill) Brooker, A.V. Slee & J.D. Briggs.

Eucalyptus series *Argyrophyllae* was erected to accommodate a range of taxa which shared some glaucous features. Only *E. cinerea*, *E. cephalocarpa* and *E. nova-anglica* are currently recognised as members of the series. *Eucalyptus cinerea* is distinguished by its neotenous habit (crown consisting of glaucous, pre-adult leaves), 3-flowered inflorescences, sessile or shortly

Abstract

Two new taxa of the series *Argyrophyllae*, silver stringybarks, are described; *Eucalyptus conspicua* subsp. *disporo* and *E. cinereo* subsp. *victoriensis*. Their morphologies, distributions, affinities and conservation statuses are discussed. As well, assessments of the taxonomic statuses of *E. triplex*, *E. alligotrix* subsp. *limoensis* and *E. olligatrix* subsp. *miscello* are given, as are occurrences of aberrant bud numbers in *E. cepholocorpo* and *E. olligatrix* subsp. *olligatrix*.

Keywords: taxonomy, Silver stringybark, neoteny, pre-adult leaves, crown structure

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pedicellate buds and relatively large fruits. *Eucalyptus cephalocarpa* is distinguished by its mature crown of blue-green adult leaves, 7-flowered inflorescences and sessile or sub-sessile buds and fruits that are slightly smaller than those of *E. cinerea*. *Eucalyptus nova-anglica* also has 7-flowered inflorescences but, in contrast to *E. cephalocarpa*, it differs by its ovoid buds and generally smaller, distinctly pedicellate fruits.

Pryor and Johnson (1971), in an informal classification of the genus, submerged the series *Argyrophyllae* within the series *Viminales* Blakely. They proposed a superspecies *Cinerea* consisting of two species, *E. nova-anglica* and *E. cinerea*, with the latter consisting of four informal subspecies; '*cinerea*', 'Beechworth' '*cephalocarpa*' and 'East Gippsland/South Coast New South Wales'.

Chippendale (1988), recognised *E. nova-anglica*, *E. cinerea* and *E. cephalocarpa* as three species within the series *Viminales*, but the informal taxa, 'East Gippsland/ South Coast New South Wales' and 'Beechworth' sens. Pryor and Johnson (1971), were not mentioned in his account.

More recently, Johnson and Hill (1990) erected *E. triplex* from the Australian Capital Territory and adjacent ranges to the east. The same authors (Hill & Johnson 1991) erected *E. conspicua*, which extends from the Latrobe Valley region of Victoria to the extreme southern coast of NSW, and *E. alligatrix* from north-east Victoria from the Lake Eildon and Beechworth areas. *Eucalyptus triplex* was distinguished from *E. cinerea* by its smaller, mallee-like habit, its crown consisting mostly of relatively small, glaucous, lanceolate adult leaves and its smaller, sessile buds and campanulate fruits. *Eucalyptus conspicua*, although being 7-flowered, was distinguished from *E. cephalocarpa* by its crown consisting of grey-green or sub-glaucous neotenous adult leaves, and from *E. cinerea*, which has 3-flowered inflorescences. *Eucalyptus alligatrix* was distinguished from other 3-flowered members of the series by its crown consisting of mainly of strongly glaucous, mostly adult leaves (some pre-adult leaves were given as being present in the mature crown).

Brooker et al. (1995) resurrected the series *Argyrophyllae* and reduced *E. triplex* to *E. cinerea* subsp. *triplex* on the basis of the crown compositions of the two being closer than Johnson and Hill had interpreted. Also, they erected *E. alligatrix* susbp. *limaensis* Brooker, Slee & J.D.Briggs to cater for populations in the Lima-Swanpool area of north-east Victoria. This new taxon was seen to differ from subsp. *alligatrix* by its taller habit, smaller buds and fruits, and its crown consisting only of adult leaves that are smaller than the type subspecies. *E. alligatrix* subsp. *miscella* was also erected to cater for a disjunct population of small woodland trees from near Rylstone in central New South Wales, its defining features given as having a mature crown only of adult leaves and some trees with mixed 3- and 7-flowered inflorescences. Further, they placed the Beechworth populations of *E. alligatrix* under *E. cinerea* on the basis that Hill and Johnson had misinterpreted the composition of its crown. Included in their circumscription of the series the authors made reference to populations of *E. conspicua* with predominantly 3-flowered inflorescences occurring in central Gippsland.

A comprehensive study using cladistic techniques of the entire *Eucalyptus* Section *Maidenaria* L.D. Pryor & L.A.S. Johnson ex Brooker was completed by Chappill and Ladiges (1992). They identified *E. cinerea* as neotenous (the mature crown being dominated by pre-adult leaves) and having more or less cylindrical fruits. In contrast, *E. triplex* was found to differ from *E. cinerea* by its mature crown being dominated by adult leaves and its fruits being campanulate. These authors did not allude to *E. triplex* being potentially a subspecies of *E. cinerea*.

Hill (2002), in the Flora of New South Wales (revised edition), continued to recognise *E. triplex* as a species. While he recognised the presence of *E. alligatrix* subsp. *alligatrix* in New South Wales, he made no reference to *E. alligatrix* subsp. *miscella* as a taxonomic entity.

Nicolle (2006), in an assessment of the silver stringybarks in south-eastern Australia did not recognise either *E. alligatrix* subsp. *limaensis* or *E. triplex*. In the case of the former he noted that differences between it and the type subspecies were minor and insufficient for its recognition. In the case of *E. triplex*, he asserted that differences in crown structure between it and *E. cinerea* were most likely due to environmental influences.

Walsh and Stajsic (2008), recognised all published Victorian taxa within the series, and listed the Beechworth form of *E. cinerea* as an informal taxon.

As is indicated in its history, the series *Argyrophyllae* is

not without controversy, particularly as the taxonomic integrities of *E. triplex* (syn. *E. cinerea* subsp. *triplex*), *E. alligatrix* subsp. *limaensis* and *E. alligatrix* subsp. *miscella*, having been brought into question. It is our view that *E. triplex* (as a subspecies of *E. cinerea*) and *E. alligatrix* subsp. *limaensis* are legitimate taxa, but not so *E. alligatrix* subsp. *miscella* which we view as being only a minor variant within the typical subspecies.

It is our view that *E. triplex* is more appropriately placed as a subspecies of *E. cinerea*, not only because of crown differences being slight, as was demonstrated by Brooker et al. (1995), but also because the campanulate fruits, as a distinguishing feature given by the authors, are not exclusive to the taxon but occur widely throughout *E. cinerea*. Further, in the case of the assertion by Nicolle (2006) regarding differences in crown structure between *E. triplex* and *E. cinerea*, we take the view that such differences are genetically fixed rather than a response to environmental conditions.

In the case of Nicolle's (2006) position regarding the status of *E. alligatrix* subsp. *limaensis*, from our investigations, which took into account numerous trees across its range (the Lima-Swanpool area), we believe that it is sufficiently different from the type subspecies in habit and adult leaf, bud and fruit sizes to warrant its maintenance as a separate taxon.

Regarding *E. alligatrix* subsp. *miscella*, it is our view that the taxon's authors did not adequately demonstrate that it is sufficiently different from the type subspecies. Habit (a small woodland tree to 15 m tall) and some trees in the population with 3- and 7-flowered inflorescences were offered as primary criteria for its segregation. However, given that the type subspecies is also a smallish, spreading tree of similar height, has some trees in the type population having 7-flowered inflorescences and is only slightly different in adult leaves, buds and fruits, it is here regarded as a minor variant.

Further, it was our opinion that, despite the publication of the new taxa since 1990, there were still unresolved issues within the series in Victoria. Thus, it has been the central aim of our studies to assess the taxonomic worth of several anomalous variants which are currently included within existing taxa. Two in particular are the neotenous, predominantly 3-flowered populations of *E. conspicua* in central Gippsland and the populations of *E. cinerea* in the Beechworth area of north-east Victoria. Also, assessments of four aberrant occurrences of *E. cephalocarpa*, namely trees with 3-flowered inflorescences in the Fryers Range in central Victoria, trees with 7–11-flowered inflorescences near Bengworden in central Gippsland, large-fruited trees on the Mornington Peninsula and trees in central and east Gippsland which resemble *E. ignorabilis* L.A.S. Johnson and K.D. Hill were considered worthy of investigation, as were trees of *E. alligatrix* with 7-flowered inflorescences occurring along the Jamieson Road close to the type locality. From our investigations we were satisfied that all four forms of *E. cephalocarpa* are minor variants within the species, as are the 7-flowered trees of typical *E. alligatrix*. However, from our investigations we found that, in the cases of and the central Gippsland form of *E. conspicua* and the Beechworth form of *E. cinerea*, taxonomic treatments are appropriate. The former is described below as *E. conspicua* subsp. *dispara* and the latter as *E. cinerea* susbp. *victoriensis*.

Methods

Historically, seedling trials involving members of the series *Argyrophyllae* (for example, Brooker et al. 1995) have consistently demonstrated that seed-lots from pure-breeding trees, regardless of the taxa involved, produce seedlings that consistently exhibit orbicular, emarginate, opposite, sessile amplexicaul, glaucous juvenile leaves. The trials conducted for our investigations, which included seed-lots of all the anomalous Victorian entities, were no exception.

In our seedling trials, seed-lots representing the type subspecies of both *E. conspicua* and *E. cinerea* and ones drawn from trees representative of both the central Gippsland form of *E. conspicua* (north-east of Seaton, west of Mt Hedrick and Freestone Creek) and the Beechworth form of *E. cinerea* (Reids Way, NNW of Beechworth, *Rule 0215*) showed uniformity in morphology, as well as consistency with seedlings that typify the series. The same outcomes occurred with seed-lots used to assess each of the forms of *E. cephalocarpa* from Bengworden, the Fryers Range, the Mornington Peninsula (Langwarrin and Bald Hill) and Genoa near Mallacoota, as well as with the 7-flowered trees of *E. alligatrix* subsp. *alligatrix*.

Of greater value were field and herbarium studies where differences between taxa in sapling and adult

morphologies across a wide range of populations of each taxon involving both vegetative and reproductive characters could be examined. Habits, barks, crowns, adult leaves, peduncles, bud numbers, buds and fruits were examined to ascertain whether the erection of the two new taxa could be justified.

Terminology

The descriptions of the leaf stages common to the taxa of the series used by Brooker et al. (1995) are adhered to in this paper except that two stages of juvenility are recognised:

Pre-adult leaves:

(a) *Juvenile leaves*: Initially, the leaves are orbicular, emarginate, opposite, sessile and amplexicaul. Later, they become cordate, sub-orbicular or broadly lanceolate but remain opposite, sessile and sometimes amplexicaul.

(b) *Intermediate leaves*: These are opposite and shortly petiolate and usually broadly lanceolate.

Adult leaves: These are disjunct, petiolate and lanceolate

Neotenous: This describes reproductively mature trees which have a crown dominated by pre-adult leaves. In this context *E. cinerea* subsp. *cinerea* and the new taxon described here, *E. conspicua* subsp. *dispara*, are considered neotenous.

Semi-neotenous: This describes trees that are partially neotenous, that is, their outer crowns feature adult leaves and their inner crowns consist of pre-adult leaves. *Eucalyptus conspicua* subsp. conspicua and *E. cinerea* subsp. *victoriensis*, the new taxon described here, and *E. cinerea* subsp. *triplex* are also considered partially neotenous. The maintenance of crowns of mixed adult and pre-adult leaves is a curious phenomenon. It would appear axiomatic that once a state of adult foliage has been achieved, the crown would progressively consist of only adult leaves as pre-adult leaves senesce. This is clearly not the case as the crowns of these taxa remain mixed, suggesting that new growth, at least initially of pre-adult leaves, is often initiated sub-apically on branches. These may or may not transition to adult leaves, whereas new apical growth on branches more commonly initiates adult leaves. Flowering occurs in axils of both pre-adult and adult leaves in the semi-neotenous species discussed in this account.

Non-neotenous: This term applies to trees with mature canopies consisting entirely of adult leaves.

Key to taxa of the Series *Argyrophyllae*

1	Crown dominated by adult leaves	2
1:	Crown consisting entirely of pre-adult leaves or a mixture of adult and pre-adult leaves	6
2	Inflorescences predominantly 3-flowered	3
2:	Inflorescences predominantly 7-flowered	5
3	Erect trees to 30 m tall; fruits 4-5 mm diam.	***E. alligatrix* subsp. *limaensis***
3:	Trees to 15 m tall, either robust and spreading or small and mallee-like; fruits 5–7 mm diam.	4
4	Spreading trees; fruits cup-shaped or broadly conical	***E. alligatrix* subsp. *alligatrix***
4:	Stunted trees (rarely to 15 m tall) or mallees; fruits campanulate	***E. cinerea* subsp. *triplex***
5	Buds ovoid, distinctly pedicellate; fruits 4–6 mm diam	***E. nova-anglica***
5:	Buds diamond-shaped, sessile or sub-sessile, fruits 5–8 mm diam	***E. cephalocarpa***
6	Crown dominated by pre-adult leaves	7
6:	Inner crown containing pre-adult leaves; adult leaves present in the outer crown	8
7	Spindly trees to 8 m tall; crown open and dominated by sub-orbicular pre-adult leaves; buds sessile	***E. conspicua* subsp. *dispara***
7:	Spreading trees to 15 m tall; crown dense and dominated by ovate, opposite and sessile pre-adult leaves; buds shortly pedicellate	***E. cinerea* susbp. *cinerea***
8	Inflorescences 7-flowered	***E. conspicua* subsp. *conspicua***
8:	Inflorescences 3-flowered	9
9	Small mallee-like trees to 15 m tall; fruits 5–7 mm diam.	***E. cinerea* subsp. *triplex***
9:	Upright trees to 30 m tall; fruits 3–5 mm diam.	***E. cinerea* subsp. *victoriensis***

E. cephalocarpa, *E. nova-anglica* and the subspecies of *E. alligatrix* are regarded as non-neotenous taxa.

Glaucous: This is (often erroneously) regarded as being synonymous with pruinose and waxy but is used here to describe leaf colour (silvery to grey-green) whereas pruinose is used to describe structures (stems, petioles, buds and immature fruits) covered with a waxy bloom.

Taxonomy

Eucalyptus conspicua subsp. *dispara* Rule & N.G. Walsh subsp. nov.

Type: **VICTORIA**. c. 2 km NW of Bulldog Junction towards Ben Cruachan, *G. Sutter s.n.*, 9. xi. 2010 (holo: MEL 2418185; iso: CANB, NSW).

A subspecies of *E. conspicua* differing from the typical subspecies by its spindly habit, a crown dominated by pre-adult leaves; inflorescences mostly 3-flowered, buds sessile and fruits tightly sessile.

Trees, small and spindly, to 8 m tall. *Stems* to 40 cm diam. at the base. *Bark* light grey, stringy, persistent throughout; inner layers of bark red-brown. *Juvenile leaves* orbicular, amplexicaul, emarginate, opposite, sessile, glaucous, slightly discolorous, 2.5–6 cm long, 2.5–6 cm wide; advanced juvenile leaves cordate or sub-orbicular, longer than wide, apiculate and sometimes often basally rounded, dominating the mature crown; nodes relatively sparse. *Seedlings* with heavily pruinose stems. *Intermediate leaves* broadly lanceolate or ovate, opposite, sessile or shortly petiolate, glaucous, sometimes present in the crown of mature trees. *Adult leaves* lanceolate, slightly falcate, petiolate, disjunct, acuminate, densely reticulate, concolorous, glaucous, 8–15 cm long, 1.7–3 cm wide, infrequently present in the mature crown; petioles 0.4–1.2 cm long, intramarginal vein *c.* 2 mm from margin; oil glands regular, small, island. *Inflorescences* simple, axillary, 3(–7)-flowered, rarely paired in the axis; peduncles slightly angular, 2–6 mm long, contracting with age, often causing mature infructescences to appear sessile. *Floral buds* diamond-shaped, sessile, operculum scar present (outer operculum shed in early bud development), 3- or 4- (rarely 5-)loculed, pruinose, 5–7 mm long, 3–4 mm wide; operculum obtuse-conical, 2.5–3.5 mm long, 3–4 mm diam.; stamens inflexed, all fertile; filaments white; anthers dorsifixed, versatile, oblong, dehiscing through longitudinal slits; ovules in 4 vertical rows. *Fruits* obconical to sub-campanulate, sessile, pruinose when immature, tightly clustered, 5–7 mm long, 5–8 mm diam.; staminal ring conspicuous, vertically-oriented; disc slightly ascending or less often flat; valves 3 or 4 (rarely 5), level with disc or slightly exserted. *Fertile seeds* blackish, irregularly elongated or oblong, lacunose; hilum ventral. *Flowering period* Autumn. (Fig. 1)

Additional specimens examined: **VICTORIA**: Freestone Creek, c. 15 km NE of Briagolong, c. 100 m N of Bullockhead Creek Track, *N.G. Walsh 6282 and A. Messina* 24.iii.2005 (MEL); 5.4 km WNW from Seaton on McEvoys Track, *V. Stajsic 3722* (MEL), 1.xii.2005. Just west of Marathon Road, 15.5 km NNW of Briagolong by road, *A. Green s.n.* 25.i.2001 (MEL 2089878); Mitchell River N.P., Billy Goat Bend Road, c. 5 km from Dargo Road, *J.A. Jeanes 3036, D. Roberts* and *N.G. Walsh*, 5.xii.2013 (CANB, MEL, NSW).

Distribution and habitat: The taxon has been located in four discrete localities in the foothills to the north of the Latrobe Valley in central Gippsland, from near Seaton in the west to the Mitchell River in the east, where it occurs on clay loam, often stony soils derived from Ordivician sandstones and siltstones. The annual rainfall of the area is between 600 and 700 mm fairly evenly distributed throughout the year. (Fig. 2)

Associated species: *Eucalyptus conspicua* subsp. *dispara* often grows as an understory plant with taller forest species including *E. sieberi* L.A.S. Johnson, *E. muelleriana* A.W.Howitt , *E. ignorabilis* L.A.S. Johnson & K.D. Hill, *E. obliqua* L'Herit., *E. consideniana* Maiden, *E. cypellocarpa* L.A.S.Johnson, *E. polyanthemos* subsp. *vestita* L.A.S. Johnson & K.D. Hill and *E. bridgesiana* R.T. Baker.

Etymology: The epithet is derived from the Latin *dispar* 'different', and alludes to it being morphologically and environmentally separable from the type subspecies of *E. conspicua*.

Conservation status: The area of occupancy is estimated at less than 20 km^2 and it is known from no more than five sites. Consequently *E. conspicua* subsp. *dispara* is regarded as Vulnerable (VU D2) *sensu* IUCN (2012) One population occurs in a national park, but the others are not within conservation reserves. Recent roadworks in the Seaton area population have destroyed about a dozen trees.

Figure 1. *Eucalyptus conspicua* subsp. *dispara* (a, b from N.G.Walsh *6282*, MEL 2276236; **c** from V.Stajsic *3722*, MEL 2283842); **a** habit, in forest with taller trees of *E. muelleriana* and *E. polyanthemos* subsp. *vestita*; **b** branchlets with buds and young fruit; **c** mature fruit.

Figure 2. Distribution of *Eucalyptus conspicua* subsp. *dispara* (triangles); *E. cinerea* subsp. *victoriensis* (circles).

Notes: Morphological, geographical and, to a large extent, ecological grounds support the erection of *E. conspicua* subsp. *dispara* as a distinct taxon. During the course of our investigations we examined populations to the north-west of Seaton and to the west of Mt. Hedrick, along the valley of Freestone Creek near Briagolong, and in the Mitchell River National Park. All these populations occur in forest communities in rather stony soils thinly overlaying Ordovician sediments in hilly country to the north of the western extremity of the range of typical *E. conspicua*. In contrast, the type subspecies tends to favour sandy soils associated with swamps, watercourses and at least seasonally moist depressions where it is usually associated with wet, heathy vegetation. An occurrence at Bullumwaal, about 20 km north of Bairnsdale, represented by a sheet at MEL (2369564, *Norris s.n.* 14.ix.2012) appears to be of hybrid origin or intermediate between subsp. *dispara* and subsp. *conspicua*. Despite most plants being 3-flowered, we found 7-flowered individuals, as well as obvious variation in habit and subtle variation in peduncle length, bud structure, fruit size, pedicel length and crown structure, all of which we regarded as being intermediate between the two entities. A population of *E. conspicua* occurring to the north-east of Bruthen, which Brooker et al. (1995) noted as containing some trees with 3-flowered inflorescences, was also visited. The trees observed were consistent with subsp. *conspicua* in all characters and no trees with 3-flowered inflorescences were located by us, although a specimen at MEL (0258592, *J.D.Briggs 2652*, 28.vii.1992) supports Brooker's observation. This population may represent a similar situation to that at Bullumwaal.

Brooker et al. (1995) recognised the 3-flowered form's distinctiveness and, while alluding to its possible links with *E. cinerea*, chose to include it with the typical 7-flowered *E. conspicua*. With reference to the population to the north-west of Seaton, they noted that, while some trees are completely neotenous, others possess crowns with a mixture of juvenile and falcate, attenuate adult leaves. However, we have surveyed this population and, whilst we located very few trees with crowns containing what could be construed as adult leaves, we found an overwhelming number of trees with crowns consisting entirely of sessile, cordate or sub-orbicular juvenile leaves. At the other sites where the new taxon occurs, only completely neotenous trees were observed. While we concur with Brooker et al. that the new taxon is closer to *E. conspicua* than *E. cinerea* we contend that it as distinctive in a range of other adult characters and, thus, worthy of taxonomic recognition.

The strength of our case for the erection of the new taxon is based on its distinctive spindly habit, its sparse, neotenous crown, its predominately 3-flowered inflorescences, its short peduncles and its tightly sessile fruits. However, we also believe that it is appropriate to place it as a subspecies within *E. conspicua* as its saplings are inseparable from those of typical *E. conspicua*, as it has a distribution adjacent to the western extremity of typical *E. conspicua* and that small numbers of 7-flowered inflorescences occur in some of its populations. In making our taxonomic decision that the new taxon is a part of *E. conspicua* we concede that future (e.g. molecular) studies may further clarify its relationships.

E. conspicua subsp. *dispara*, being predominantly 3-flowered has obvious links with *E. cinerea* and its subspecies, all of which occur on the inland side of the Great Dividing Range. The typical subspecies of *E. cinerea*, which occurs between Bathurst and Tumut in the Central and Southern Tablelands of New South Wales, differs from *E. conspicua* subsp. *dispara* by being a spreading robust, large-trunked tree with a crown dominated by smaller, densely packed pre-adult leaves and inflorescences that are completely 3-flowered. The Beechworth occurrence of *E. cinerea* (described below as a new subspecies) differs from this new subspecies by its taller habit, it dense crown with outer adult leaves, its consistent three-flowered inflorescences and its smaller buds and fruits (see Table 1).

Eucalyptus cinerea subsp. *victoriensis* Rule & N.G.Walsh subsp. nov.

***Type*: VICTORIA:** NNE of Beechworth, McFeeter's Road, E of Beechworth-Chiltern Road, adjacent to the turn-off to Woolshed Falls, *K.Rule 0315*, 16.v.2015 (holo: MEL 2418187; iso: CANB, NSW).

Eucalyptus aff. *cinerea* (Beechworth) *sensu* VicFlora (*VicFlora* (2016). Flora of Victoria, Royal Botanic Gardens Victoria, <https://vicflora.rbg.vic.gov.au>, last accessed 7 Mar. 2018).

Eucalyptus cinerea subsp. Beechworth (J.D. Briggs 2607) *sensu* APC (CHAH (2006), *Australian Plant Census* https://id.biodiversity.org.au/reference/apni/42942, last accessed 7 Mar. 2018).

A subspecies of *E. cinerea* differing from the type subspecies in its taller, more upright habit, its outer crown containing lanceolate, pendulous adult leaves and its smaller buds and fruits.

Small to medium-sized, erect trees to 30 m tall. Inner crown containing cordate to broadly lanceolate, opposite, sessile pre-adult leaves; outer crown dominated by lanceolate, disjunct, pendulous adult leaves. *Bark* light grey, rough, stringy, thick, deeply furrowed, extending to secondary branches; inner layers of bark red-brown. *Juvenile leaves* orbicular, emarginate, opposite, sessile and amplexicaul for numerous pairs, slightly discolorous, glaucous, 2–3 cm long, 2–3 cm wide; advanced juvenile leaves cordate, ovate or broadly lanceolate; nodes relatively crowded. *Seedlings* with heavily pruinose stems. *Intermediate leaves* ovate-lanceolate or broadly lanceolate, opposite, sessile or shortly petiolate, acuminate or apiculate. *Adult leaves* lanceolate, petiolate, disjunct, pendulous, acuminate, moderately reticulate, concolorous, glaucous, 6–10 cm long, 1–2.3 cm wide; crown dense; petioles 2–16 mm long; intramarginal vein c. 1 mm from margin; oil glands regular, small, numerous, mostly island. *Branchlets* pruinose. *Inflorescences* simple, axillary, 3-flowered; peduncles slender, 2–7 mm long. *Floral buds* diamond-shaped, sub-sessile on short thick pedicels to 2 mm long, scarred, 3- or 4-loculed, pruinose, 5–7 mm long (excluding pedicel), 3–4 mm wide; operculum obtuse-conical, 2.5–3.5 mm long, 3–4 mm wide; stamens inflexed, all fertile, filaments white; anthers dorsifixed, versatile, oblong, dehiscing through longitudinal slits; ovules in 4 vertical rows. *Fruits* obconical to campanulate, pruinose when immature, 4–5 mm long, 3–5 mm wide; pedicels 0–2 mm long; staminal ring, narrow, ascending vertically; disc narrow, flat or slightly ascending; valves 3 or 4, exserted. *Fertile seeds* blackish, dull, cuboid to oblong, lacunose; hilum ventral. *Flowering period* Autumn. (Fig. 3)

Table 1. Comparison of the morphologies of *E. cinerea* and *E. conspicua*.

Taxon	*E. cinerea* subsp. *cinerea*	*E. cinerea* subsp. *triplex*	*E. cinerea* subsp. *victoriensis*	*E. conspicua* subsp *conspicua*	*E. conspicua* subsp. *dispara*
Habit	spreading tree to 15 m tall	small tree or mallee to 15 m tall	small to medium erect tree to 30 m tall	Small, spreading tree to 15 m tall	small spindly tree to 8 m tall
Crown composition	dominated by pre-adult leaves, adult leaves rarely present	consisting entirely or mostly of adult leaves	inner crown of pre-adult leaves, outer crown containing adult leaves	Inner crown of pre-adult leaves, outer crown of adult leaves	crown consisting of pre-adult leaves, adult leaves rarely present
Adult leaves shape	lanceolate, slightly falcate, rarely present	lanceolate, slightly falcate, dominating the crown	lanceolate, slightly falcate, abundantly present	Lanceolate, slightly falcate	lanceolate, slightly falcate, rarely present
size (cm)	to 10 x 3.5	to 12 x 4.5	to 10 x 2.3	to 14 x 3	to 15 x 3
petiole length (cm)	to 1	to 1.4	to 1.6	to 2	to 1.2
Inflorescences bud number	3-flowered	3-flowered	3-flowered	7-flowered	3(7)-flowered
peduncle length (mm)	3–8	3–5	2–7	4–8	2–6
floral buds size (mm)	6–11 x 4–5	6–8 x 3–4	5–7 x 3–4	5–8 x 3–5	5–7 x 3–4
operculum length (mm)	3–5	c. 3	2.5–3.5	3–5	2.5–3.5
pedicel length (mm)	0–2	0–2	0–2	1–3	0
Fruits shape	campanulate, obconical, sub-cylindrical	campanulate	campanulate, obconical	campanulate, obconical	obconical to sub-campanulate
size (mm)	5–8 x 5–8	5–7 x 6–8	4–5 x 3–5	5–8 x 4–7	5–7 x 5–8
disc orientation	ascending	ascending	flat or slightly ascending	flat or ascending	flat or slightly ascending
pedicel length (mm)	0–2	0–2	0–2	0–2	0

Additional specimens examined: 8 km from Beechworth along the Chiltern Road, *M.D. Crisp 7101*, 9.ii.2007 (MEL); c. 2.4 km S of Mt Pilot, c. 9.6 km N of Beechworth, *A.C. Beauglehole 43595*, 23.xi.1973 (MEL); McGuiness Lane at Corner of Chiltern-Mt Pilot N.P., *G. Earl s.n.* 24.vi.2004 (MEL); Reid's Way, N of Beechworth, adjacent to Beechworth-Wodonga Road, *K.Rule 0215*, 16.v.2015 (MEL); N of Beechworth-Yackandandah Road, *N.G.Walsh 8155* 13.iii.2014 (CANB, K, MEL); Road to Woolshed Creek Falls, 1 km W of Beechworth-Chiltern Road, *N.G.Walsh 3304*, 19.xi.1992 (CANB, MEL)

Distribution and habitat: The new subspecies occurs in hilly country to the north and north-east of Beechworth where it favours clay loam soils derived from Devonian granites. Beechworth has a mean annual rainfall of approximately 700 mm, most of which falls in winter. (Fig. 2)

Associated species: Commonly associated species include *E. blakelyi* Maiden, *E. bridgesiana*, *E. nortonii* L.A.S.Johnson and *E. macrorhyncha* F.Muell. ex Benth.

Figure 3. *Eucalyptus cinerea* subsp. *victoriensis* (all from N.G.Walsh *8155*, MEL 2379871); **a** habit; **b.** pre-adult leaves; **c.** adult leaves and buds; **d.** fruits.

Etymology: The name alludes to the new subspecies being an endemic Victorian taxon.

Conservation status: Originally, stands of *E. cinerea* subsp. *victoriensis* would have occupied an area of several square kilometres but now the taxon is estimated to comprise less than a thousand individuals in the Chiltern-Pilot National Park and on nearby farms and roadsides, with the area of occupation calculated at less than 1 km^2. In accordance with IUCN (2012) guidelines, a status of Endangered is recommended (E B1ab, 2ab) While it is capable of regeneration after bushfires, further clearing along roadsides and on private property may threaten its numbers. Additionally, little recruitment has been observed, particularly in roadside stands.

Notes: *Eucalyptus cinerea* subsp. *victoriensis* differs from typical *E. cinerea* by it taller habit, its capacity to consistently produce adult leaves in its outer crown in its mature form and its smaller buds and fruits. It is also our contention that its erection offers clarification in the face of confusion and misreporting regarding its morphology. For example, Brooker et.al. (1995), whilst taking into account the smallness of its buds and fruits, gave descriptions of habit and crown composition consistent with New South Wales populations of *E. cinerea* and not the Beechworth form. Further, Brooker and Slee (1997), in the *Flora of Victoria*, gave descriptions for habit, crown composition and bud and fruit sizes that were consistent only with the typical subspecies. Further still, Nicolle (2006), in his account of the Beechworth form, noted that its crown is composed entirely or partly of juvenile leaves, which describes both immature and mature trees of the form. As well, his descriptions of fruit sizes were incorrect as he, like the above authors, gave the dimensions of typical *E. cinerea*.

We agree with Brooker et al. (1995) that the Beechworth form should not be included with *E. alligatrix* on the bases of both crown composition and fruit structure. Mature trees of *E. alligatrix* and its subspecies, unlike the partial neoteny of the Beechworth trees, have crowns consisting entirely of adult leaves. References to *E. alligatrix* subsp. *alligatrix* having a crown of adult leaves with some pre-adult leaves present in the inner crown appear to be based on observations of immature trees. At the type locality, for example, trees with crowns consisting entirely of adult leaves grow on the banks of the Big River adjacent to smaller, somewhat less mature trees with crowns containing a small proportion of inner pre-adult leaves. With regard to fruits, there are subtle differences in structure. Those of *E. alligatrix* have a prominently ascending disc, giving the fruit a globoid shape, whereas the fruits of the Beechworth trees have discs that are more or less flat.

It is important to note that in *E. cinerea* subsp. *victoriensis* the production of outer adult leaves occurs in the crowns of mature trees. In contrast, the crowns of saplings and young trees consist entirely of opposite, sessile, ovate or lanceolate pre-adult leaves.

It is our view that the erection of the new taxon as a subspecies of *E. cinerea* is justified as it differs from the type subspecies by its taller, more erect habit (subsp. *cinerea* being a spreading tree to 15 m tall), the outer crown containing disjunct, petiolate, lanceolate adult leaves, and its smaller buds (to 1.1 cm long, 0.5 cm wide in subsp. *cinerea*) and smaller fruits (0.5–0.8 cm long, 0.5–0.9 cm wide in subsp. *cinerea*).

The new taxon differs from both the recognised subspecies of *E. alligatrix* which have crowns that consist of entirely adult leaves and fruits that are more or less globoid and non-pruinose branchlets, buds and fruits. *Eucalyptus alligatrix* subsp. *alligatrix* further differs from the new taxon by its larger buds and fruits (fruits 5–7 mm long, 5–8 mm diam.). *E. alligatrix* subsp. *limaensis* also differs from the new taxon by its narrow-lanceolate blue-green adult leaves.

The mature trees of *E. cinerea* subsp. *victoriensis* differ from *E. cinerea* subsp. *triplex* in crown composition, with the latter having a somewhat sparse crown entirely or mostly of adult leaves whereas the former has an appreciably dense crown containing mostly pre-adult leaves with adult leaves present in the outer crown. Subsp. *victoriensis* further differs from subsp. *triplex* by its taller habit and its smaller buds and fruits (fruits of subsp. *triplex* 5–7 mm diam.). (see Table 1)

Acknowledgements

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regarding the population of silver stringybarks at Bullumwaal, to John Topp of Valencia Creek for bringing to our attention the presence of trees of *E. cephalocarpa* at Bengworden with 11-flowered inflorescences and to the late Ern Perkins of Castlemaine for his assistance in the field, particularly with regards the populations of *E. cephalocarpa* which contains trees with 3-flowered inflorescences. Lastly, we are deeply indebted to David Cameron of the Arthur Rylah Institute for his advice with many aspects of the research involved in the study.

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Muelleria

36: 92-96

ROYAL
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A new species of *Poa* L. (Poaceae) from Kosciuszko National Park, New South Wales

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Abstract

A new species of *Poa*, *P. mireniana* N.G.Walsh & K.L.McDougall sp. nov., currently known only from lower, western slopes in the Kosciuszko National Park near Talbingo is described and illustrated. Its known distribution, ecology and conservation status, and relationship with other members of the genus are discussed. Its stoloniferous habit and general appearance imply a close relationship to *P. tenera*, but it possesses some features that suggest this relationship may be superficial. The new species is characterised by an extensively rhizomatous and/or stoloniferous habit, short, flat to weakly folded leaf blades and a relatively long, membranous ligule.

Keywords: Taxonomy, *Poa tenera*, MIREN

Introduction

In the course of recent surveys of native and introduced plants on transects at increasing altitudes from foothills to the highest mountains in Australia (Kueffer et al. 2014), a distinctive, apparently undescribed *Poa* L. was encountered in steep mountain forests of generally south-western aspect between 900 and 1050 m altitude. The opportunity is taken here to describe this new species in the hope that further surveys in similar country may improve the understanding of the species.

Taxonomy

Poa mireniana N.G.Walsh & K.L.McDougall sp. nov.

Type: **NEW SOUTH WALES.** Kosciuszko National Park, c. 50 m below Snowy Mtn Hwy, 4 km direct E from Talbingo, 5.1.2018, *K. McDougall 1490* (holotype: MEL 2418238; isotypes: CANB, K, MELU, NSW, US — yet to be distributed).

In its general rhizomatous/stoloniferous habit, resembling *Poa tenera*, but differing from it in the broader, coarser and usually shorter leaves, the relatively long, membranous, tapered ligule, the conspicuous collar,

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the slender, tardily expanded inflorescence and the spikelets which usually contain more numerous florets.

Slender rhizomatous and/or stoloniferous perennial. Leaves mostly cauline. Culms sometimes weakly scandent but ultimately erect, to c. 40 cm high, elliptic in section toward base, distinctly flattened for a few internodes below inflorescence, glabrous, or with a few hairs immediately below the nodes; nodes glabrous. New shoots intravaginal. Leaf sheaths not pigmented, rather prominently 5–9-nerved with or without finer parallel nerves between, glabrous or with scattered, spreading hairs near the sheath-blade junction; margins fused in the lower c. one-quarter, free above. Ligule conspicuous, membranous, 1.2–2(–3) mm long, tapered, rounded or obtuse, abaxially pilose with hairs to c. 0.3 mm long. Collar region conspicuous, yellowish, dilated and usually loosely folded near its junction with the ligule margin. Leaf blades green, not glaucous, usually flat or slightly folded in vivo, often inrolled on drying, 3–10 cm long, 1–3 mm wide when flattened, rather conspicuously 5–9-veined, abaxially scabrous along the larger veins or occasionally smooth, sometimes sparsely pilose with hairs to c. 0.3 mm long, adaxially sparsely to moderately pilose with fine spreading hairs to c. 0.5 mm long; tip acute, navicular. Inflorescence usually slender, remaining contracted, or finally the branches spreading, 3–11 cm long, 1–5 cm wide. Spikelets (2–)3–5-flowered, 2.7–4.5 mm long, basically green but glumes and florets with pale translucent margins, or the margins sometimes tinged purplish. Glumes, 1.7–2.5 mm long, the upper slightly longer than the lower, 3/4–1 × the length of the proximal lemma, acute, keel sparsely and shortly scabrous, intercostal regions smooth and scabrous. Lowest lemma c. 2.5 mm long, broadly acute in profile, 5-nerved, the midrib sparsely scaberulous toward apex, intercostal regions glabrous or sparsely pubescent toward base; web absent or weakly developed and then usually only on the lowest floret, to c. 0.5 mm long. Palea slightly shorter than its lemma, scabridulous along the keels at least in lower half. Anthers 0.7–1.3 mm long. (Figs 1–3).

***Specimens examined*: NEW SOUTH WALES.** Snowy Mountains Highway, ca 6.5 km SE of Talbingo, 2.xii.2011, *K.McDougall 1386 & G. Wright* (MEL); Snow[y] Mountains Highway, ca 4.5 km ESE of Talbingo, 2.xii.2011, *K.McDougall 1385 & G. Wright* (MEL); Kosciuszko National Park, near Snowy Mtn Hwy, 4.5 km direct ESE from Talbingo, 4.x.2017, *N.G. Walsh 8732, K. McDougall & G. Wright*. Crown Land, 1 km SW of Batlow on road to Tumbarumba, 30.v.1999, *N.M. Taws 1015* (CANB, MEL, NSW).

Distribution and habitat: *Poa mireniana* is currently known only from foothill to montane forests of the Kosciuszko National Park in the vicinity of Talbingo, and nearby in Crown Land near Batlow, New South Wales. To date it has been recorded only in steeply west- and south-west falling slopes of Devonian geology within an altitude range of 900 to 1050 m. Associated species include *Eucalyptus dalrympleana* Maiden subsp. *dalrympleana*, *E. radiata* subsp. *robertsonii* (Blakely) L.A.S.Johnson & Blaxell, *E. viminalis* Labill. subsp. *viminalis*, *Acacia dealbata* Link subsp. *dealbata*, *A. melanoxylon* R.Br., *Cassinia aculeata* (Labill.) R.Br. subsp. *aculeata*, *C. longifolia* R.Br., *Lomatia myricoides* (C.F.Gaertn.) Domin, *Platylobium montanum* I.Thomps. subsp. *montanum*, *Pteridium esculentum* (G.Forst.) Cockayne subsp. *esculentum*, *Geranium* spp., *Senecio prenanthoides* A.Rich., *Viola hederacea* Labill.. Sites may be heavily shaded or rather open. One collection is from a disturbed road verge where occurring with ruderal weeds. Soils are typically rather shallow overlying the rhyolitic parent rock.

***Conservation Status*:** Currently known from only five collections, but at each of those sites locally common to subdominant. The forest type – Community u165 of Armstrong et al. (2013) – is common on the western side of the Australian Alps Bioregion between the Brindabella Ranges to the Geehi Valley and so it would seem likely that the species is more widespread and previously overlooked. Indeed, there are numerous unvouchered records of *P. tenera* from vegetation plots of montane forest in the Talbingo / Bago / Manjar area of western Kosciuszko National Park and adjacent State Forest (NSW Bionet Atlas, http://www.bionet.nsw.gov.au/, accessed 19 Sep. 2017), which may represent *P. mireniana*. Given this uncertainty, an appropriate IUCN assessment would be 'data deficient' (IUCN Red List of Threatened species, http://www.iucnredlist.org/technical-documents/categories-and-criteria, accessed 22 Nov. 2017).

***Etymology*:** The epithet 'mireniana' commemorates the Mountain Invasion Research Network (MIREN) under whose auspices the survey work that brought the

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Pocket Empty
National Herbarium of Victoria (MEL)
HOLOTYPE
Poa mireniana N.Walsh & K.L.McDougall
Determinavit N.Walsh 22-i-2018
NATIONAL HERBARIUM OF VICTORIA (MEL)
MELBOURNE, AUSTRALIA
MEL 2418238
Poa aff. tenera F.Muell. ex Hook.f.
Det.: McDougall, K.L., 5 Jan. 2018
Coll.: McDougall, K.L. 1490 Date: 5 Jan. 2018
Australia: New South Wales
Loc.: Kosciuszko National Park, c. 50 m below Snowy Mtn Hwy, 4 km direct E from Talbingo.
35° 35' 17" S 148° 20' 45" E, Alt.: 900 m.
Habitat: Montane forest. Steep, SW aspect. Shallow, rocky soil.
Associated taxa: Acacia dealbata, Cassinia aculeata, Cassinia longifolia, Coprosma hirtella, Dichondra repens, Eucalyptus radiata subsp robertsonii, Lagenophora stipitata, Leucopogon lanceolatus, Lomatia fraseri, Microlaena stipoides, Pteridium esculentum, Stellaria pungens, Viola hederacea.
Descriptive notes: Rhizomatous perennial with some aerial branching. Leaves flat in vivo.
Collecting notes: Of restricted occurrence, but locally the dominant ground-layer species.
Dupl.: CANB, K, MELU, NSW, US
353. Poaceae – M. Monocots – Main collection (5. Australasia)
Printed from MELISR, 05 Feb. 2018
TYPE
NATIONAL HERBARIUM OF VICTORIA (MEL), AUSTRALIA

Figure1. *Poa mireniana* holotype (*K.L. McDougall 1490*, MEL). Photo by Angharad Johnson. Reproduced with permission by RBGV.

Figure 2. *Poa mireniana* ligule and collar (from *Walsh 8732*, MEL); scalebar 2 mm. Photo by Ian Clarke.
Figure 3. *Poa mireniana* spikelet, florets separated from glumes (from *Walsh 8732*, MEL); scalebar 2 mm. Photo by Ian Clarke.

new species to light was carried out. MIREN is a global affiliation of botanists undertaking comparative surveys in mountains around the world to record 'invasions' into mountain floras as a consequence of direct and indirect human activities. For further information about MIREN, see http://www.mountaininvasions.org/.

Notes: The overall appearance of *P. mireniana*, in particular, its stoloniferous or rhizomatous habit and predominantly cauline leaves, suggests a taxonomic proximity to *P. tenera* F.Muell. ex Hook.f., a species mostly of moist, shaded, lowland to montane forests of south-eastern Australia. The long ligules, conspicuous collar, short, broad and generally adaxially scabrous leaves, contracted inflorescences and spikelets with more numerous florets of *P. mireniana* suggest that the similarity to *P. tenera*, which does not possess these characters, may be superficial only.

Regarding *P. tenera*, Vickery (1970) noted 'some difficulty has been experienced in comprehending the limits of *P. tenera* and there is no doubt that further field studies are required'. She emphasised the presence of 'slender smooth leaves and distinctly membranous ligules' as being characteristic features of *P. tenera*, while noting collectors' comments that 'it may display a tussocky phase'. To date, *P. mireniana* has not been observed as a tussock. Vickery described the ligule of *P. tenera* as being 0.5–1.5 mm long, while Walsh et al. (2009) applying a stricter circumscription of the species give a measurement of 0.3–0.4 mm long. Since Vickery's 1970 treatment of *Poa* in Australia, at least two species probably referable to *P. tenera* in her circumscription of the species, have been described — *P. amplexicaulis* C.M.Weiller & Stajsic and *P. orthoclada* N.G.Walsh, both of which have longer ligules than described by Walsh et al. (2009), but generally shorter than those of *P. mireniana*. Unlike *P. mireniana*, both these species are caespitose, although sometimes with short ascending stolons, and have distinctly pigmented leaf sheaths and smooth, folded to inrolled leaves. Their segregation from *P. tenera* at least partially explains the discrepancies between the two accounts. If Vickery had seen any specimens of *P. mireniana*, it is possible that she would have included

them within her concept of *P. tenera* and these, plus the two more recently named species would account for her 'difficulty in comprehending the limits' of the species. As her range of leaf width (1–1.5 mm) is below that of *P. mireniana* (1.5–3 mm), it also suggests that she did not examine any specimens now referable to *P. mireniana*. As well as the leaves of *P. mireniana* being broader, their texture is coarser than that of *P. tenera* which, on herbarium specimens, typically has leaf blades thinly membranous, often almost translucent between the relatively prominent veins, of which there are fewer than in *P. mireniana*.

Acknowledgements

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Muelleria

36: 97-106

ROYAL BOTANIC GARDENS VICTORIA

Drosera gunniana comb. et stat. nov., a species in the *Drosera peltata* (Droseraceae) complex

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Introduction

The complex of closely-related species that includes *Drosera peltata* Thunb. has a complicated nomenclatural and taxonomic history (Table 1). *Drosera peltata* was originally described (Thunberg 1797) using a type from New South Wales. Thunberg's authorship of *D. peltata* was soon overlooked (Conn 1981), with authors after de Candolle (1824) almost unanimously attributing its authorship to J. E. Smith [published by Willdenow 1798]. The distribution of the complex spans from the Himalayas to south-east Asia (Japan, China, Philippines), down to southern Australia and New Zealand (Gibson et al. 2012).

The *D. peltata* complex was revised by Gibson et al. (2012), who recognised *D. peltata sensu stricto*, occurring in New South Wales, Victoria and Tasmania; *D. auriculata* Backh. ex Planch. in Queensland, New South Wales, Victoria, South Australia and Tasmania, as well as New Zealand; *D. hookeri* in Queensland, New South Wales, Victoria, South Australia, Tasmania and New Zealand; *D. lunata* Buch.-Ham ex DC. in New South Wales and Queensland to south-east Asia, Japan and the Himalayas; and *D. yilgarnensis* R.P. Gibson & B.J. Conn in Western Australia.

Gibson et al (2012) provided a taxonomic review of the group, and suggested that the type of *Drosera peltata* Thunb. was conspecific with the taxon then recognised as *D. gracilis* Hook.f. ex Planch. and had been broadly misapplied by most authors after Thunberg to multiple

Abstract

A recent revision of the *Drosera peltata* Thunb. complex left a morphologically and ecologically distinct species with no valid combination at the species rank, treating it under *D. hookeri* R.P.Gibson, B.J.Conn & Conran (Gibson et al., 2012). The new combination *D. gunniana* (Planch.) de Salas is proposed for a robust, erect, single-stemmed taxon to which the name *D. peltata*, and more recently *D. hookeri*. have been widely misapplied. A new key to *Drosera* species in Tasmania and descriptions and illustrations of *D. hookeri* and *D. gunniana* are included.

Keywords: *Drosera peltata* complex, combination, morphology, sympatry, Tasmania

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Table 1. Names used for taxa in the *Drosera peltata* complex by various authors in a Tasmanian context.

Author / Current treatment	*Drosera auriculata*	*Drosera peltata*	*Drosera hookeri*	*Drosera gunniana*
Thunberg (1797)	-	*D. peltata*	-	-
Labillardière (1805)	-	*?D. peltata*	-	-
de Candolle (1824)	-	*?D. peltata*	-	-
Planchon (1848)	*D. auriculata*	*D. gracilis*	*D. foliosa*	*D. peltata* var. *gunniana*
Hooker (1860)	*D. auriculata*	*D. gracilis*	*D. foliosa*	*D. peltata* var. *gunniana*
Bentham (1864)	*D. auriculata*	*D. peltata* var. *gracilis*	*D. peltata* var. *foliosa*	*D. peltata* var. *peltata*
Rodway (1903)	*D. auriculata*	*D. peltata* var. *gracilis*	*D. peltata* var. *foliosa*	*D. peltata* var. *peltata*
Curtis & Morris (1975)	*D. auriculata*	*D. gracilis*	*D. peltata*	*D. peltata*
Conn (1981)	*D. peltata* subsp. *auriculata*	*D. peltata* subsp. *peltata*	*D. peltata* subsp. *peltata*	*D. peltata* subsp. *peltata*
Marchant (1982)	*D. auriculata*	*D. peltata*	*D. peltata*	*D. peltata*
Morris (2009)	*D. auriculata*	*D. gracilis*	*D. foliosa*	*D. peltata*
Gibson et al. (2010)	*D. auriculata*	*D. gracilis*	*D. hookeri*	*D. peltata*
Baker & de Salas (2012)	*D. auriculata*	*D. gracilis*	*D. hookeri*	*D. peltata*
Gibson et al. (2012)	*D. auriculata*	*D. peltata*	*D. hookeri*	*D. hookeri*

morphotypes that Gibson et al. treated within their broadened circumscription of *D. hookeri*.

Four species within this complex occur in Tasmania, and extend to south-eastern mainland Australia. *D. auriculata* is common throughout the island at all but the highest elevation habitats, it has pink flowers and is the only Tasmanian species in this group with glabrous sepals. *Drosera peltata* Thunb. (= *D. gracilis*) is common in swampy, peaty ground and permanently wet habitats such as seeps and riparian corridors, from sea level to montane elevations. It grows later in the season, when the other species are dormant, and is generally slender, single-stemmed, with basal leaves and stems stained red, and with hirsute calyces and a white corolla. The flower and fruit size is smaller than the other members of the complex in south-eastern Australia. Both species are morphologically distinct and easily distinguished, and detailed descriptions and a key are provided in Gibson et al. (2012). A third taxon, *Drosera foliosa* Hook.f. ex Planch. (1848) was described from Tasmanian material collected by R.C. Gunn. and has been recognised as distinct by most authors since. As originally described, it is a grassland and grassy woodland species, which in Tasmania is found mostly in the north and north-east. A complete description and discussion of its distinctive features are given below. However, Hooker's name was illegitimate, being predated by *Drosera foliosa* Elliott 1821 (see Gibson et al. 2010). Gibson et al. (2010) provided the replacement name *Drosera hookeri* R.P.Gibson, B.J.Conn & Conran, and chose as a lectotype one of Gunn's collections from the 'Formosa' property, near Cressy, Tasmania.

The fourth taxon is one to which the name *Drosera peltata* has most often been incorrectly applied in Tasmania and south-eastern mainland Australia (Table 1). It is common through the south-east, primarily in dry woodland habitats, extending into grassland. It has a distinctive morphology, and has been recognised by various authors (Planchon 1848, Bentham 1864, Rodway 1903, Morris 2009). A complete description and discussion of its distinctive features are given below. Tasmanian specimens of this taxon were used by Planchon as the basis for *Drosera peltata* var. *gunniana* Planch., a name that has been largely ignored. Although Gibson et al. (2012) recognised that *D. hookeri* is comprised of various morphotypes, and that occasionally these grow sympatrically while remaining distinct, they nevertheless chose to include both *Drosera peltata* var. *genuina* Planch. (presumably what Planchon considered the typical form from Port Jackson, the type locality of *D. peltata*) and *Drosera peltata* var. *gunniana* within their broader concept of *D. hookeri*.

Examination of material from south-east Australian herbaria (AD, HO, MEL, NSW), and in the field at their Tasmanian type localities, makes it clear that the types of *D. hookeri* (as *D. foliosa*) and *D. peltata* var. *gunniana*,

are not conspecific and can be distinguished reliably. The new combination *Drosera gunniana* (Planch.) de Salas is proposed for Planchon's *D. peltata* var. *gunniana* and a lectotype is designated.

Materials and Methods

Work carried out for this study consisted of field excursions to various localities where taxa in the *D. peltata* complex are known to co-occur. Herbarium material from the Tasmanian Herbarium (HO), the State Herbarium of South Australia (AD), the National Herbarium of Victoria (MEL) and the National Herbarium of NSW (NSW) was examined with a Wild Heerbrugg stereomicroscope. Seed were observed and drawn using the same microscope, with the aid of a Wild TYP 25675 drawing mirror, the originals digitised and converted to vector drawings using Inkscape v0.92. Live plant photographs were obtained with a Pentax K5 digital camera and a Pentax D-FA 100 mm F2.8 Macro WR lens, with post-processing in Adobe Lightroom 5.3.

Results and Discussion

Many authors, including Hooker (1860), Bentham (1864), Rodway (1903) and Morris (2009), had recognised *D. hookeri* (as *D. foliosa* or *D. peltata* var. *foliosa*) as distinct from what they considered to be the standard form (in Tasmania) of *D. peltata*, while Curtis and Morris (1975), Conn (1981), and Marchant et al. (1982) used a broader circumscription and treated *D. hookeri* in synonymy under *Drosera peltata* Thunb. The revision of the *Drosera peltata* group by Gibson et al. (2012) clarified that the name *D. peltata* Thunb. had been broadly misapplied in Australia, and chose to treat the main taxon to which the name had been misapplied in the south-east under a broadened circumscription of *D. hookeri*, a small and distinctive species with a Tasmanian type. The name *Drosera peltata* var. *gunniana* Planch., based on collections by R.C. Gunn from three Tasmanian localities (the 'Formosa' property near Cressy, the 'Penquite' property inside modern-day Launceston, and New Norfolk) is available, and a good match for the taxon to which the name *D. peltata* had been misapplied in SE Australia by most authors until Gibson et al. (2012). This name has been ignored by subsequent authors or treated in synonymy under a misapplied *D. peltata*. However, even in the protologue of *D. peltata* var. *gunniana*, Planchon (1848) speculated that this variety may be a different species from *D. peltata* altogether ("*... an spec. propria?*", p. 297).

In Tasmania, this taxon is abundant, particularly in the northern part of the State, and it can still be collected at two of the three localities mentioned by Planchon (Formosa and New Norfolk). The Penquite property no longer exists, having been absorbed by the suburbs of the City of Launceston, but this taxon is common in the surrounding area.

Drosera peltata var. *gunniana* is morphologically distinct from *D. hookeri*. It is a much taller plant with a single main axis that can reach 30 cm tall or more with a terminal inflorescence (Fig. 1A), compared to the short, multi-stemmed habit of *D. hookeri*. The latter often matures its earliest fruits within 1 or 2 cm of the basal rosette (Fig. 3B), whereas *D. peltata* var. *gunniana* flowers and ripens fruit well above the ground. The general plant colour is also different: *D. hookeri* is yellow-green to distinctly yellow, whereas *D. peltata* var. *gunniana* is pale olive green, often suffused with orange, and can range to almost entirely red. *Drosera peltata* var. *gunniana* has flower buds that range from dark olive green to dark maroon and are approximately spherical. Its calyx lobes are somewhat spreading after anthesis, and are covered with a dense indumentum of long hairs best described as hirsute (Fig. 3C). The flower buds of *D. hookeri* are yellowish-green and longer than broad. Its calyx lobes clasp the capsule after anthesis and are covered in a short indumentum which in dried specimens is often paler than the sepal lamina (Fig. 3D). The seed of *D. hookeri* (Fig. 2A), although described by Gibson et al. (2012) as being 0.3–0.4 mm long, were found to be considerably longer than this (0.6–0.7 mm long) in both Tasmanian specimens from the type locality and mainland Australian specimens, and longer than those of *D. peltata* var. *gunniana* (Fig. 4B). They are cylindrical in *D. hookeri*, and ellipsoidal to ampulliform in *D. peltata* var. *gunniana* (Fig. 4). As well as being morphologically distinct, the two taxa occupy somewhat separate environmental niches: *Drosera hookeri* is normally found in damp, open grassland habitats, whereas *D. peltata* var. *gunniana* prefers heathy and grassy woodland. In northern Tasmania, populations of both taxa are commonly found adjacent to each other or overlapping

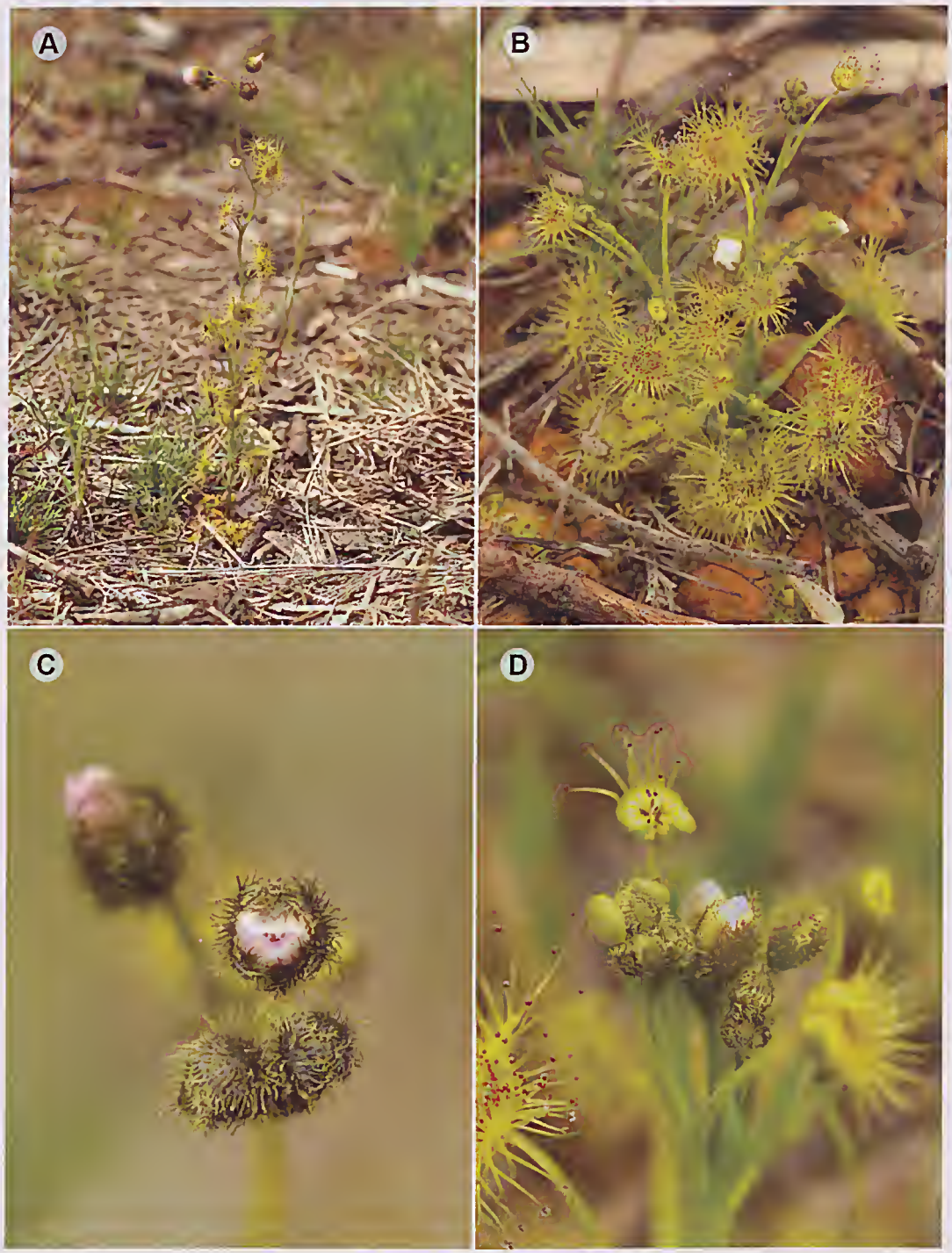

Figure 1. Habit and inflorescence detail of *Drosera hookeri* and *D. gunniana*. **A.** Simple-stemmed, erect habit of *D. gunniana*. Note multiple vegetative nodes below the inflorescence. **B.** Short, multi-stemmed habit of *D. hookeri*. Note inflorescence arising from first vegetative node. **C.** Inflorescence detail of *D. gunniana*. Note the long indumentum and almost spherical buds. **D.** Inflorescence detail of *D. hookeri*. Note the short indumentum and elongated buds.

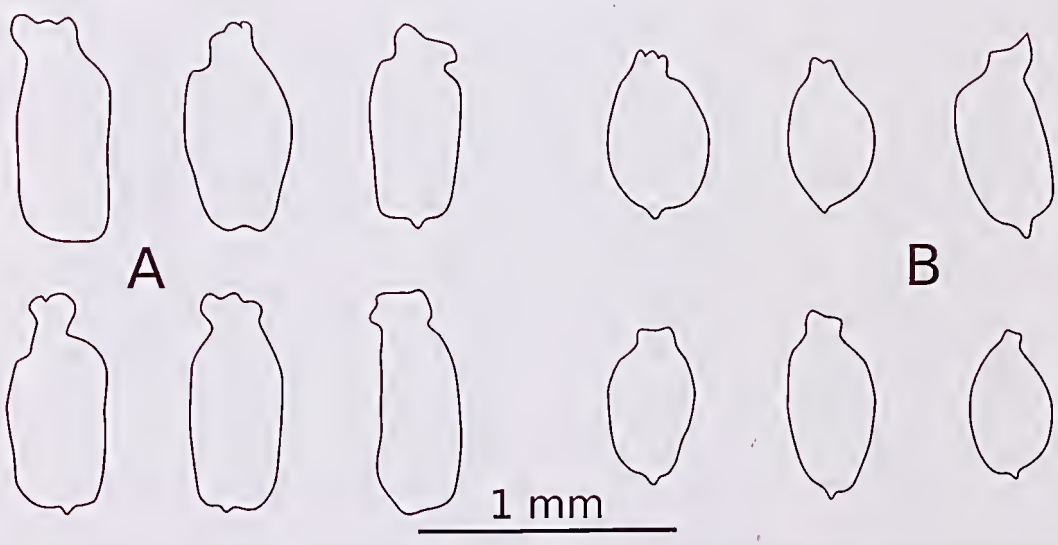

Figure 2. Seed morphology of *Drosera hookeri* and *D. gunniana*. Scale bar = 1 mm. **A.** Seed of *D. hookeri*. Note cylindrical shape, almost like a bottle. **B.** Seed of *D. gunniana*. Note ellipsoidal, almost ampulliform shape.

(for example *de Salas 270, 271; de Salas 275, 276; de Salas 314, 315; de Salas 394, 395, de Salas 1043, 1045*). Wherever this happens, individuals in a population can be easily assigned to one taxon or the other, and intermediate forms are extremely rare. Despite this, mixed herbarium sheets containing both *D. peltata* var. *gunniana* and *D. hookeri* are not rare. In addition to mixed sheets, Gunn used taxon numbers rather than collection numbers, and many of Gunn's collections have more than one gathering of the same taxon number mounted on the same sheet, making it impossible to determine which gathering a specimen belongs to. This has necessitated the designation of a lectotype for *D. peltata* var. *gunniana* (see below). A lectotype for *D. hookeri* was already designated by Gibson et al. (2012).

In conclusion, the concept of *D. hookeri* as treated by Gibson et al (2012) contains in synonymy an additional species that can be reliably distinguished morphologically in the field and from herbarium specimens, for which the new combination *Drosera gunniana* is created in this study.

Taxonomy

The following descriptions and key serve to differentiate *D. hookeri* and *D. gunniana*. Intermediate forms are rare in Tasmania, although very robust specimens of *D. hookeri* growing in sheltered sites can begin to branch higher up the main stem and resemble *D. gunniana*. Conversely, specimens of *D. gunniana* that are damaged by grazing animals early in the season can develop multiple stems. The most reliable characters to separate the two taxa are shape and indumentum of the flower buds and fruits, tuber colour, branching pattern and petal colour. A key to all Tasmanian *Drosera* is included, and supersedes the one in Morris (2009).

Drosera hookeri R.P.Gibson, B.J.Conn & Conran, *J. Adelaide Bot. Gard.* 24: 41 (2010)

Drosera foliosa Hook.f. ex Planch., *Ann. Sci. Nat.*, sér 3, 9: 298 (1848), *nom. illeg.* non *Drosera foliosa* Elliott, *Sketch Bot. S. Carolina* 1: 376 (1817). *Drosera peltata* var. *foliosa* (Hook.f. ex Planch.) Benth., *Fl. Austral.* 2: 465 (1864).

***Type*: TASMANIA.** Formosa [near Cressy], 7 Dec. 1842, R.C.Gunn 1027 (lectotype: K215054 K215054 *fide* Gibson, Conn & Conran (2010), top row, middle specimen, photo!, Fig. 3; residual syntype: HO3402!).

Small, tuberous perennial *herb* to 10 cm tall, often forming closely-packed colonies. *Tubers* externally white. *Stems* often repeatedly branching from near the base, yellowish green to distinctly yellow, with no red staining. *Basal rosette leaves* well-developed, always present at flowering; petiole flattened, 5–14 mm long, lamina 7–11 mm in diameter, semi-orbicular,

lunate, not peltate. *All cauline leaves* yellow-green; petiole 5–11 mm long; lamina 3–6 mm in diameter, crescentic, auriculate or occasionally the auriculate lobes absent. *Inflorescence* often subtended by only one or two vegetative internodes, 1–several branched, branching from the base, each branch terminating in a short raceme, resulting in a growth habit with flowers and leaves mixed along much of the plant's height; *bracts* linear-lanceolate, fimbriate, c. 2.5 mm long. *Flower buds* longer than wide. *Sepals* green, 2.5–3 mm long, 1.5–2.5 mm wide, appressed to the capsule after anthesis, margin ciliate, apex obtuse, often fimbriate; indumentum sparse, hairs 0.3–0.6 mm long, semi-appressed to appressed, longer on the margins and paler than sepal lamina. *Petals* white, 4–5 mm long, obovate, drying cream or white. *Seeds* black, cylindrical with a short neck, 0.6–0.7 mm long and c. 0.25 mm in diameter, surface reticulated.

Selected specimens examined: **SOUTH AUSTRALIA.** Glen Shera Swamp by top pump shed, *R.J. Botes 60238* (MEL2375311); 11.4 km direct NNE of Warrow, *P.J. Long BS128-3096* (AD175B05); Mt. Lofty, ca. 15 km south-east of Adelaide, *s.c., s.n.* (AD97618569); Kangaroo Island, 5 km NE of Cape Younghusband, *P. Copley NPKI 20270* (AD99026185); Bordertown edge of recreation lake reserve, *D.E. Murfet 7517* (AD259213); Berkins Scrub Native Forest Reserve, *D.E. Murfet 4581* (AD156394). **TASMANIA.** Kelso & George Town, N. Tas., 23.x.1844, *R.C. Gunn 1027* (HO3412); 'Formosa', Cressy, 4.xi.1844, *R.C. Gunn s.n.* (HO3407); Little Musselroe Bay, *A. Moscol 2971* (HO70161); Fingal Valley Road, *F. Duncon s.n.* (HO326475); Campbell Town Golf Course, *H.&A. Wopstro s.n.* (HO515933); Conara Park ('paddock'), *H.&A. Wopstro s.n.* (HO528561); 'Forest Hall', Cleveland, *H.&A. Wopstro s.n.* (HO528559); Valleyfield Road just W of Macquarie Road intersection, N side of road, *M.F. de Solos 276* (HO568007); Exeter, junction of West Tamar Highway and Beaton Street, north Side of Beaton Street, west side of highway, in mowed area in front of houses, *M.F. de Solos 394* (HO571066); Fingal. Mangana Road, approximately 500 m SW of Mathinna Road and Bridge over South Esk River, *M.F. de Solos 1043* (HO575876). **VICTORIA.** Volcanic Plain. E side of Forest Lane, 10.1 km SW of Dunkeld, *P.C. Jobson 3954* (MEL2028326); Dookie Agricultural College Reserve (hill 4 km S of Mt Major), *I. Crowford 1928* (MEL274583); Western Port, French Island, Albions Point, *C. Gordes 103A* (MEL2011B09, specimens marked 'A' only).

Distribution and ecology: Grassland, grassy woodland and open, grassy habitats such as mowed lawns, in Victoria, South Australia and Tasmania, at low to mid elevations. Flowering Sep.–Nov. and dormant during the summer months.

Drosera gunniana (Planch.) de Salas, comb. et stat. nov.

Basionym: *Drosera peltata* var. *gunniana* Planch. *Ann. Sci. Nat.* sér 3, 9: 297 (1848).

Drosera peltata Thunb. *sensu* J.D. Hooker, *Bot. Antarct. Voy. III. (Fl. Tasman.).* 1(1): 30 (1855); W.M. Curtis & D.I. Morris, *The Student's Flora of Tasmania* ed. 2, 1: 188 (1975) *p.p.*; Marchant et al., *Fl. South Australia* Ed. 4, 1: 363 (1986) *p.p.*; N.G. Marchant, *Fl. Australia* 8: 22 (1982) *p.p.*; D.I. Morris, *Flora of Tasmania Online* (2009, accessed 12 Jan 2018); *Electronic Flora of South Australia* (accessed 12 Jan 2018) *p. p. Drosera peltata* subsp. *peltata sensu* B.J. Conn, *J. Adelaide Bot. Gard.* 3(1): 97 (1981) *p.p. D. peltata* var. *peltata sensu* G. Bentham, *Fl. Austral.* 2: 465 (1864) *p.p.*; L. Rodway, *Tasman. Fl.* 48 (1903) *p.p.*

Type: **TASMANIA.** "...in insula Van Diemen, locis dictis: *Formosa, Penquite, New Norfolk*; Gunn. n° 448 in herb. Hook." (lectotype here chosen: Formosa [Cressy], 4 Nov. 1843, R.C.Gunn 448 (K 215594, lower leftmost specimen on sheet as indicated in Fig. 4, photo!. Residual syntypes: Penquite, 9 Nov. 1843, *R.C. Gunn 448* (K000215595 photo!, HO3405!); New Norfolk, 2 Nov. 1839, R.C. Gunn 448 (K000215593 photo!)

D. hookeri R.P.Gibson, B.J.Conn & Conran *sensu* R.P. Gibson et al., *Austral. Syst. Bot.* 25: 66 (2012) *p.p.*; A. Messina, *Vicflora* (2015, accessed 12 Jan 2018) *p.p.*

Tuberous perennial *herb* to 30 cm tall, forming loose colonies. *Tubers* pink or red externally. *Stems* erect, simple or branched from the upper nodes, occasionally branched from the base but generally with one clearly dominant main stem, green to red, often suffused orange or red near the base. *Basal rosette leaves* moderately well-developed, usually present at flowering; petiole flattened, 3–14 mm long, lamina 5–10 mm in diameter, semi-orbicular-lunate, not peltate. *Lower cauline leaves* sometimes reduced to a petiole with a minute unexpanded lamina; *upper cauline leaves* yellow-green, sometimes reddish; petiole 7–10 mm long; lamina crescent-shaped, auriculate, peltate, 5–6 mm in diameter. *Inflorescence* subtended by several vegetative internodes, (5–)8–22(–30+) mm high, yellow-

Figure 3. Lectotype of *Drosera hookeri* (highlighted). Note the multi-stemmed habit and fruit ripening near ground level. Reproduced with permission of Kew.

Fig. 4. Lectotype of *Drosera gunniana* (highlighted). Note erect, single-stemmed habit. Reproduced with permission of Kew.

green or reddish, branching from the top one or two vegetative nodes, or unbranched; *flowers* in axillary and terminal racemes; *bracts* lanceolate, fimbriate, hairy. *Flower buds* approximately spherical. *Sepals* green or blackish, 3–5 mm long and wide, only loosely clasping the capsule or spreading after anthesis, margins fimbriate, apex truncate; indumentum dense 0.8–1.2 mm long, scarcely longer on the margins, the same colour as the sepal lamina. *Petals* pink or white, 5–8 mm long, obovate, drying pink. *Seeds* black, ovoid to almost cylindrical with a short neck, 0.5 mm long, c. 0.25 mm wide, surface reticulated.

Selected specimens examined: **NEW SOUTH WALES.** Near Tucabia, *F.M. Isoac 1006* (MEL152927); Pound Creek Station, 0.6 km E5E of farmhouse, *P.H. Weston 2632* (N5W610367); 59 Park River Close, Mulgoa, *R. Gibson 1* (NSW413172). **SOUTH AUSTRALIA.** Newland Head Conservation Park, Parsons Beach Area, *D.E. Murfet 7617* (AD265691); Berkins Scrub Native Forest Reserve, *D.E. Murfet 4573* (AD156383); Nuriootpa, *D.J.E. Whibley 1432* (AD96816115); Sandy Creek (ca. 45 Km north-east of Adelaide), *M. Fagg 224* (AD96719018). **TASMANIA.** New Norfolk, 1834, *R.C. Gunn s.n.* (HO3413); 'Glen Leith' [Plenty], 9.x.1839, *R.C. Gunn 448* (HO38070); 'Formosa', Cressy, 7.x.1842, *R.C. Gunn s.n.* (HO3409); Proctors Road, Hobart, *A.M. Olsen s.n.* (HO411564); Deep Bay, Cape Barren Island, *P. Collier 3515* (HO118339); Valley Rivulet, north of Broadmarsh, *P. Collier 3468* (HO118492); 'Forest Hall', Cleveland, *H.&A. Wapstra s.n.* (HO528564); Pontville. Ford Road. Informal crown reserve on the SE side of the Jordan River ford, *M.F. de Salas 49* (HO564701); Fingal-Avoca Road, 100m past picnic area, *M.F. de Salas 67* (HO563478); Valleyfield Road just W of Macquarie Road intersection, N side of road, *M.F. de Salas 275* (HO568008); Exeter, junction of West Tamar Highway and Beaton Street, north side of Beaton Street, west side of highway, in mowed area in front of houses, *M.F. de Salas 395* (HO571067); Hobart Airport. Approximately 250 m southwest of airport roundabout, off Cranston Parade, *M.F. de Salas 421* (HO572652); Fingal, Mangana Road, approximately 500 m SW of Mathinna Road and bridge over South Esk River, *M.F. de Salas 1045* (HO575874). **VICTORIA.** Rushworth Forest; c. 4 km due west of Ballieston, *M.G. Corrick 7893* (HOS2025); Golton Track about 10 km W of Dadswell Bridge, *D.E. Murfet 4535*

Key to Tasmanian *Drosera*

1 Leaves in a basal rosette only; tubers absent **2**

1: Leaves cauline, basal rosette present or absent at flowering time; plant with a vertical rhizome arising from a globose tuber **6**

2 Leaf lamina deeply divided into two or occasionally more, linear lobes ..... ***D. binata***

2: Leaf lamina entire **3**

3 Stipules present, conspicuous, scarious **4**

3: Stipules absent or small and fused to the petiole **5**

4 Flowers solitary, minute, on slender scapes; leaf lamina orbicular ..... ***D. pygmaea***

4: Flowers few to many on a narrow secund raceme; leaf lamina spathulate ..... ***D. spatulata***

5 Leaves orbicular, < 2 cm long; peduncle glandular-pubescent ..... ***D. glanduligera***

5: Leaves linear-oblong; peduncle glabrous **6**

6 Number of glandular leaves (3–)4–6, 20–70 mm long; outer, non-glandular leaves reduced or absent ..... ***D. arcturi***

6: Number of glandular leaves 1–2, 60–100(–200) mm long; outer, non-glandular leaves present, spreading ..... ***D. murfetii***

7 Stem leaves orbicular, peltate, lacking angular lobes; stems trailing, scrambling or climbing ..... ***D. macrantha***

7: Stem leaves lunate, the margins extended as 2 angular lobes; stems erect **8**

8 Sepals glabrous ..... ***D. auriculata***

8: Sepals hirsute **9**

9 Stems very slender, unbranched, frequently leafless in the upper half; basal rosette leaves red; seeds narrow-turbinate, slightly arcuate ..... ***D. peltata***

9: Stems branched or unbranched, leafy to the inflorescences; basal rosette leaves yellow to green; seeds ovoid to ampulliform or cylindrical **10**

10 Plant up to 10 cm high with a distinctly yellow-green colour; tubers white; stems often several or if solitary then branched from near the base; inflorescences from lower and upper nodes; sepal indumentum sparse, < 0.6 mm long; petals white, drying white, 4–4.5 mm long ..... ***D. hookeri***

10: Plant (5–)8–22(–30+) cm high with a pale olive-green to dark red colour; tubers pink or red; stems usually solitary, or branched in the upper half; inflorescence from the upper nodes only; sepal indumentum dense, > 0.8 mm long, often > 1 mm; petals white or pink, drying pink, 5–8 mm long ..... ***D. gunniana***

(MEL2375318A); Terrick Terrick National Park. Eastern boundary ca. 600 m west-north-west of Reigel's Rack, *W.A. Gebert 330* (MEL2375996); Mount Lawson State Park, *A.C. Beauglehale 90378* (MEL1577687); 6.5 km E of Warrak, c. 3 km SSE of Ben Nevis, *I.C. Clarke 1958* (MEL1582379); Little Desert National Park. East Camp grounds, track towards park boundary, *B.M. Overtan 1081* (MEL1576629); 5km E of Lake Lawloit, *A.C. Beauglehole 84215* (MEL1577679); Pine Mountain National Park, *A.C. Beauglehale 88745* (MEL1577685); Approx. 10km NE of Lancefield, Boland Rd?? access track due N of Mt William winery, *A.C. Cochrane 243* (MEL2052384).

Distribution and ecology: Woodland, grassy woodland and extending onto open, grassy habitats such as lawns, in New South Wales, Victoria, South Australia and Tasmania, at low to mid elevations. Flowering Sep.–Nov. and dormant during the summer months.

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Muelleria

36: 107–111

ROYAL
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VICTORIA

Viola curtisiae, a new rank for a poorly understood species, with notes on *V. hederacea* subsp. *seppeltiana*

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Introduction

Adams (1982), in a revision of *Viola* L. for the *Flora of Australia* based largely on a study of herbarium specimens, described seven subspecies under a broadly circumscribed *V. hederacea* Labill., five of which were new while the sixth, *V. hederacea* subsp. *sieberiana* (Spreng.) L.G. Adams was recombined at subspecies rank from *V. sieberiana* Spreng. Adams used subspecies rank for these taxa as he regarded *V. hederacea* as a polymorphic complex, with evidence of intergradation ("clinal variation") between some of his named taxa. Adams thus considered that the Australian-endemic *Viola* sect. *Erpetion* (D.C. ex Sweat) Benth. c Hook. f. comprised only two species, *V. hederacea* and *V. improcera* L.G. Adams.

Field studies by a number of authors have shown, however, that most of Adams' subspecies are morphologically discrete and do not intergrade even when growing in close sympatry or when intermixed. Hence, three species-ranked taxa have been raised from Adams' subspecies, viz. *V. cleistogamoides* (L.G. Adams) Seppelt, *V. fuscoviolacea* (L.G. Adams) T.A. James and *V. perreniformis* (L.G. Adams) R.J. Little & Leiper. *Viola sieberiana* was regarded as distinct by Thiele & Prober (2003), and is currently

Abstract

Violo hederocea subsp. *curtisioe* has till now been a poorly understood taxon, represented by very few specimens from near Mount Field, Tasmania. Field and glasshouse observations of a *Viola* found on the Mount Baw Baw plateau, Victoria, showed that it matches the protologue of *V. hederacea* subsp. *curtisiae*. Field observations at the type locality in Tasmania confirm this. *Violo hederoceo* subsp. *curtisioe* and *V. hederoceo* subsp. *hederoceo* co-occur with no intermediates, indicating that species rank is preferable for the former; it is here recombined as *V. curtisioe* (L.G.Adams) K.R.Thiele, and shown to have a broader distribution, including in Tasmania, than previously recognised. *Viola hederocea* subsp. *seppeltiano* is discussed, and determined to be more closely related to *V. sieberiono* than it is to *V. hederaceo*. Accordingly, there are now no recognised subspecies in *V. hederocea*.

Key words: Violaceae; taxonomy; rare species

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accepted at species rank by the Australian Plant Census (Council of Heads of Australasian Herbaria 2006–). Three new species, *V. banksii* K.R. Thiele & Prober, *V. eminens* K.R. Thiele & Prober, and *V. silicestris* K.R. Thiele & Prober, have been described since the Adams treatment, resulting in ten currently accepted taxa in sect. *Erpetion*.

Two subspecies (in addition to the autonymic subsp. *hederacea*) remain in Adams' concept of *V. hederacea*, viz. subsp. *seppeltiana* and subsp. *curtisiae*. Thiele & Prober (2003) considered that *V. hederacea* subsp. *seppeltiana*, which occurs in South Australia and western Victoria, cannot be distinguished morphologically from *V. sieberiana*, which occurs on the Hawkesbury Sandstones near Sydney, and treated it under that species. The State Herbarium of South Australia accepts *V. hederacea* subsp. *seppeltiana* as a synonym of *V. sieberiana*, but the Australian Plant Census maintains it as distinct pending resolution of its status (Council of Heads of Australasian Herbaria 2006–). *Viola sieberiana* and *V. hederacea* subsp. *seppeltiana* share a ±rectangular anterior petal that is pale at the base and coloured at the apex, ±concolorous, pale blue flowers and spathulate leaves with cuneate leaf bases. In this they are both clearly distinct from *V. hederacea sens. str.*, which has an obovate anterior petal that is coloured towards the base and white at the apex, discolorous (violet and white) flowers, and reniform leaves with cordate leaf bases. *Viola hederacea* subsp. *seppeltiana* should thus be regarded either as conspecific with *V. sieberiana*, as a species, or as a subspecies of *V. sieberiana*. We recommend the former pending resolution of its status with respect to *V. sieberiana*. It is clearly not a subspecies of *V. hederacea*.

Viola hederacea subsp. *curtisiae* was erected to accommodate two specimens, both from the vicinity of Mount Field in Tasmania, which Adams considered differed from typical *V. hederacea* in having the lateral petals without a beard, with short flowering scapes scarcely exceeding the leaves, and all petals emarginate or bilobed. He described the corolla as concolorous or discolorous and blue-violet (although the type has no colour information on the collecting notes and the flowers are faded). The type (*W. Curtis s.n.*, HO 29454) was collected from "Mt Mawson" in 1948, while a second cited specimen (*I.R.H. Telford 2175*, CBG 27187.1) was collected from Lake Dobson in 1969. The latter locality is c. 2 km from the summit of Mt Mawson; the specimens may have been collected from the same locality.

Since Adams' treatment two other specimens from Tasmania have been determined as *V. hederacea* subsp. *curtisiae*, *viz. J.M.B. Smith 258* (HO 36373) from "Near Lake Dobson", and *A.M. Gray 1160* (HO 520456) from Russell Falls Creek. The latter locality is c. 10 km east of the former, in an area of substantially lower elevation (220 m *cf.* >1000 m) and rainfall, and in a very different habitat (mossy wet sclerophyll forest vs. alpine snow gum woodland). It was redetermined to typical *V. hederacea* in 2017 (MdS). Re-examination of the collections at HO has revealed one additional specimen (*A.E. Orchard 5201*, HO 443311) collected from the vicinity of Mount Wellington near Hobart in 1981. *Viola hederacea* subsp. *curtisiae* is thus known from only four collections in Tasmania, all from the south east of the state at similar elevations and all from the same dolerite substrate and the same broad vegetation type.

In 1990, a specimen of *Viola* of uncertain affinities (*Lester & Davies s.n.*, MEL 1593752) was collected in Victoria from near Mt Erica on the Baw Baw Plateau. This entity has been treated in published censuses of Victorian plants as *V. hederacea* subsp. nov. (Baw Baws) since Ross (1993), including in the most recent census (Walsh & Stajsic 2007). It was suggested by T. James (NSW) *in litt.* (1995) to have possible affinities with *V. hederacea* subsp. *curtisiae*, and was discussed in a note under *V. hederacea* in the *Flora of Victoria* (Entwisle 1996). In 2015, one of us (AM) collected sterile, living material of this entity from Mount Erica, which was subsequently grown on in the Melbourne nursery of the Royal Botanic Gardens Victoria. This retained field characters that were significantly different from *V. hederacea*, with concolorous, white flowers on short scapes no longer than the leaves, although the glasshouse-grown plants were substantially more robust and leafier than field plants.

Field work in 2017 showed that the plants are distinctive, and occur at several sites on the Baw Baw Plateau, where they occupy a distinct habitat separate from and at higher elevations than typical *V. hederacea*. The latter is common on roadside banks and relatively dry, loamy slopes at a wide range of elevations from the foot of Mount Erica to just below the edge of the summit plateau at an elevation of 1030 m, in a range

of forest types including *Eucolyptus regnons* F. Muell. and low-elevation *E. radioto* Sieber ex D.C. forest. Plants have relatively long scapes, usually longer than the leaves, with flowers that are consistently and distinctly bicoloured (violet and white) with bearded and twisted lateral petals. In contrast, plants from the summit plateau above 1050 m, growing in moist *Eucalyptus regnons*, *E. gloucescens* Maiden & Blakely, *E. delegatensis* R.T. Baker, *E. nitens* (H. Deane & Maiden) Maiden and *Nothofogus cunninghomii* (Hook.) Oerst forest, have concolorous flowers (petals white adaxially, white with obscure purplish markings abaxially) on short scapes, with beardless and non-twisted lateral petals. Both taxa were found to be morphologically highly consistent, and with no intergradation.

Subsequently, one of us (MdS) revisited the type population of *V. hederoceo* subsp. *curtisiae* at the Mount Mawson Ski Field, where plants were found growing abundantly on sheltered, east-facing gentle slopes beneath *Eucalyptus coccifero* Hook. f woodland with stunted *Nothofogus cunninghomii*. These were consistent in all respects with the Victorian plants, and clearly comprise the same taxon. Other collections at HO show that typical *V. hederoceo* also grows in close proximity to the type population, at Lake Fenton (2.5 km east of Lake Dobson, with the same elevation and substrate), and on Mount Wellington.

The morphological consistency of plants referred to *V. hederocea* subsp. *curtisiae*, both at each locality and between the disjunct populations, consistent differences from typical *V. hederoceo*, and lack of intergradation with that species despite their close proximity at the Mt Erica site and at Mt Field and Mt Wellington, lead us to conclude that, as with the other subspecies described by Adams (1982), *V. hederacea* subsp. *curtisioe* is best treated at species rank. Accordingly, it is recombined here as *V. curtisioe* (L.G.Adams) K.R.Thiele.

Taxonomy

Viola curtisiae (L.G.Adams) K.R.Thiele, comb. et stat. nov.

Violo hederoceo Labill. subsp. *curtisiae* L.G.Adams, *Fl. Aust.* 8: 386 (1982). *Type:* Tasmania. Mt Mawson, Mt Field National Park, 6 Jan. 1948, *W.M. Curtis s.n.* (*holo:* HO 29454).

Viola hederacea subsp. nov. (Baw Baws) *sensu* Ross 1993, 1996, 2000; Ross & Walsh 2003; Walsh & Stajsic (2007).

Perennial herb spreading widely by stolons; rootstock sometimes somewhat swollen and bulbous at the stem bases. *Stems* contracted with leaves forming rosettes, never elongate with caulescent leaves. *Leoves* with petioles (0.5–)2–5 cm long; *lomina* ±semi-circular to slightly reniform, the largest 6–15 mm long, 8–22 mm wide, *c.* 1.2–2 times wider than long, broadly cuneate, truncate or broadly cordate at base, with 7–13 indistinct teeth, glabrous or sparsely hispid with scattered unicellular hairs *c.* 0.5 mm long on the upper surface mostly toward the margins, dark green and usually slightly glossy above, dull greyish-green beneath; *stipules* 2–3 mm long, narrowly triangular or trifid, usually with several small, glandular teeth on each side. *Flowers* on scapes to 3 cm long, mostly shorter than the leaves (often considerably so), rarely subequal to or slightly longer than leaves. *Brocteoles* at the base or in the basal 1/2 of the scape, narrowly triangular, c. 3 mm long, c. 0.5 mm wide. *Sepols* 2.5–4 mm long. *Petols* concolorous or slightly discolorous, white adaxially sometimes with faint purplish venation or pale violet patches towards the centre-lines of some petals, abaxially white or variably purple-flushed; segments not widely opening but with ±reflexed apices; entire corolla often ±broadly cylindrical to broadly campanulate; *onterior petal* 5–7 mm long, 3–5 mm wide, broadly elliptic, widest at or very near the middle, broadly emarginate, 3(–5)-nerved at base, the nerves dividing and becoming indistinct above midway; *loteral petols* 5–6.5 mm long, 2.5–3.5 mm wide ±rectangular, slightly falcate, broadly emarginate at apex, not twisted, glabrous (i.e. beardless); *dorsol petols* 5–6.5 mm long, 2.5–3.5 mm wide, obovate, rounded to truncate, usually emarginate, occasionally minutely apiculate in the notch. *Anthers* c. 1.5 mm long, cream; *onther oppendoges* exceeding anthers by 1–2 mm, the terminal portion slightly dilated and straw-coloured, minutely papillate, the proximal portion white, pilose; *glands on ventral onthers* cream to green, shorter than the anther cells, irregularly rugose, ±allantoid; *pollen* and interior margins of the anther cells white to cream. *Ovory* pale green, faintly lilac-mottled; style 1.2–1.8 mm long, erect but distinctly geniculate at its insertion on the ovary. *Fruit* broadly ellipsoid, 6–8 mm

long, cream at maturity. *Seeds* ovoid, 1.9–2.1 mm long, *c.* 1.3 mm diam., uniformly dull brown or with indistinct, minute, pale mottling, ±smooth. (Figure 1)

Diagnostic features: May be distinguished from all other taxa in *Viola* sect. *Erpetion* by the combination of semi-circular to slightly reniform leaves, flowers concolorous white to slightly discolorous (i.e. with or without obscure purplish markings abaxially and obscure purplish veins or patches adaxially) on short scapes not exceeding the leaves, petals all ± emarginate, and lateral petals beardless and gently reflexed but not twisted.

Other specimens examined: **VICTORIA.** Baw Baw National Park, Alpine Walking Track between Mount Erica carpark and Mushroom Rocks, *K. Lester & J. Dovies s.n.*, 29.xi.1990 (MEL); Baw Baw National Park, beside Alpine Walking Track, *c.* 400 m north from Mt Erica carpark, *N.G. Wolsh 4900*, 22.xii.1998 (MEL); Mt Baw Baw Village Road 3.6 km from Mt Baw Baw Village, *K.R. Thiele, S.M. Prober & K. Seoton KRT5449*, 15.xii.2017 (MEL); Baw Baw National Park, Mt Erica Road 0.4 km from right turn to carpark near summit plateau, *K.R. Thiele, S.M. Prober & K. Seoton KRT5450*, 15.xii.2017 (MEL). **TASMANIA.** Mt Mawson, National Park, *W.M.Curtis s.n.*, 6.i.1948 (HO); Lake Dobson, Mt Field National Park, *I.R. Telford 2175*, 2.ii.1969 (CBG); near Lake

Figure 1. *Viola curtisioe*. Plant photographed from *K.R. Thiele* 5450, Mt Erica, Victoria

Dobson, Mt Field, *J.M.B. Smith 258*, 6.i.1978 (HO); The Lectern, Mt Wellington, *A.E. Orchard 5201*, 13.i.1981 (HO); Urquhart Track, Mount Field NP, *J. Little s.n.*, S.ii.2017 (HO); Mt Field NP, Lake Dobson. Start of track to Mawson Ski Area, *M.F. de Salas 1927*, 26.xii.2017 (HO, MEL); Mt Field NP, Track to Mawson Ski Area, approximately 200 m NW of Lake Dobson, *M.F. de Salas 1928*, 26.xii.2017 (HO, CAN8); Mt Field NP, Mt Mawson Ski Area, approximately 400 m W of Eagle Tarn, *M.F. de Salas 1929*, 26.xii.2017 (HO, MEL).

Phenology: Flowers in late spring and summer.

Distribution and habitat: Currently known from three widely disjunct localities: the Lake Dobson–Mt Mawson area in Mount Field National Park, and near Mount Wellington, both in Tasmania; and along the southern rim of the Baw Baw Plateau in Victoria. In Tasmania it occurs in sheltered, east-facing sites beneath *Eucalyptus coccifera* woodland with scattered *Nothofagus cunninghamii*, whereas in Victoria it occurs beneath tall forest of *Eucalyptus regnans*, *E. nitens*, *E. delegatensis* and *E. glaucescens* with scattered *N. cunninghamii*, in both cases at elevations above 1000 m.

Two further localities are given in the Tasmanian Natural Values Atlas (https://www.naturalvaluesatlas.tas.gov.au/downloadattachment?id=14622), at Lake Ewart in Cradle Mountain Lake St Clair National Park and at Mt Huxley near Queenstown. However, these are based on unvouchered observational records and cannot be verified. It is possible that *V. curtisiae* has been overlooked in other locations, both in Tasmania and Victoria, in similar habitats and elevations.

Conservation status: *Viola curtisiae* is listed (as *V. hederacea* subsp. *curtisiae*) as rare under the Tasmanian *Threatened Species Protection Act 1995*. It is not currently listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*. In both Victoria and Tasmania, its known occurrences are wholly contained within national parks.

Notes: *Viola curtisiae* is a distinctive species that is clearly localised and rare, even if some populations have been overlooked. Its leaves are semi-circular to slightly reniform and not much broader than long, very similar to those of *V. hederacea sens. str.* In having concolorous to slightly discolorous flowers it is similar to *V. cleistogamoides*, *V. fuscoviolacea*, *V. sieberiana* and *V. silicestris*. However, the first two of these have substantially smaller flowers, with the petals (white in *V. cleistogamoides*, very dark purple in *V. fuscoviolacea*) scarcely exceeding the sepals, while the latter two species have concolorous pale blue flowers on long scapes. The lateral petals in *V. curtisiae* are consistently beardless, a useful feature for distinguishing it from *V. hederacea*.

Distinctively also, all petals are shallowly to distinctly emarginate, and all are ± the same width. The lateral petals are gently reflexed but not twisted. The flowers thus present a distinctive, "almost actinomorphic" aspect that is unique in sect. *Erpetion*. This feature, while noticeable in fresh flowers, is difficult to assess from pressed specimens.

The epithet, which commemorates Dr Winifred M. Curtis, is similar to that of *Viola curtisii* E.Forst., the basionym of *V. saxatilis* subsp. *curtisii* (E. Forst.) Kirschner & Skalický and *V. tricolor* subsp. *curtisii* (E. Forst.) Syme (the currently accepted name for the taxon; see The Plant List 2013); this species commemorates William Curtis (Rix 2014). Given the different genders and, now, different ranks, we do not consider these to be confusable epithets.

With *V. hederacea* subsp. *curtisiae* now raised to species rank, and subsp. *seppeltiana* clearly allied with or synonymous with *V. sieberiana*, *V. hederacea* is now a morphologically relatively consistent species without infraspecies.

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Muelleria

36: 112–117

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Viola serpentinicola (Violaceae), a new Tasmanian species endemic to serpentinised ultramafic soils

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Abstract

Recent field work in western Tasmania has led to the identification of the new species *Viola serpentinicola* de Salas sp. nov. This species is abundant in areas where serpentinised ultramafic geologies are exposed to the surface, and does not extend beyond their geological boundary. Every ultramafic outcrop sampled in western Tasmania contained the new species, although it is absent on the Anderson Creek ultramafic complex in the central north, and the Adamsfield ultramafics in central southern Tasmania. The new species is characterised by its large, showy, discolorous flowers and deltoid, dark-green coriaceous leaves. A new key to *Viola* L. in Tasmania is provided.

Keywords: *Viola hederacea* complex, *Viola* section *Erpetion*, geology, ultramafics, Tasmania

Introduction

Prior to Adams's (1982) revision of *Viola* L. for the *Flora of Australia*, most of what are now considered to be distinct species in section *Erpetion* consisted of only two taxa: *V. hederacea* Labill. and *V. sieberiana* Spreng. Adams (1982) reduced *V. sieberiana* to a subspecies of *V. hederacea* and described a further five subspecies: *V. hederacea* subsp. *cleistogamoides* L.G. Adams, *V. hederacea* subsp. *curtisiae* L.G. Adams, *V. hederacea* subsp. *fuscoviolacea* L.G. Adams, *V. hederacea* subsp. *perreniformis* L.G. Adams and *V. hederacea* subsp. *seppeltiana* L.G. Adams. All of these, except for *V. hederacea* subsp. *seppeltiana*, have since been promoted to species rank (Jessop et al. 1986; James 1996; Little and Leaper 2013; Thiele et al. 2018), and an additional three species: *V. banksii* K.R.Thiele & Prober, *V. eminens* K.R.Thiele & Prober and *V. silicestris* K.R.Thiele & Prober have been described (Thiele and Prober 2003, 2006). For notes on the taxonomic status of *V. hederacea* subsp. *seppeltiana* and a general discussion of current taxonomy within Viola section *Erpetion* (D.C. ex Sweet) Benth. & Hook. f. see Thiele et al. (2018).

Four species of section *Erpetion* are known to occur in Tasmania: *V. hederacea*, *V. cleistogamoides* (L.G. Adams) Seppelt, *V. curtisiae* K.R. Thiele and *V. fuscoviolacea* (L.G. Adams) T.L. James (de Salas and Baker 2017; Thiele et al. 2018; Duretto 2009). Recent field work on ultramafic serpentinised substrates on the west coast of the island revealed a new, fifth distinctive taxon that appears to be endemic to areas of serpentinised

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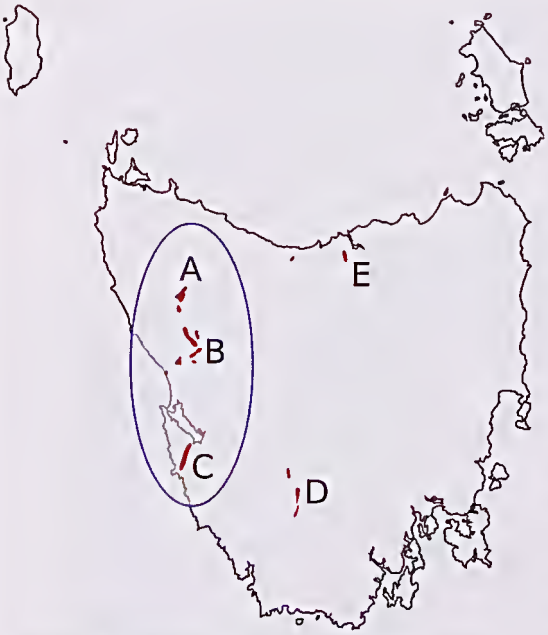

Figure 1. Distribution of ultramafic rocks in Tasmania. **A.** Savage River area. **B.** Harman River / Wilson River / Serpentine Ridge (and minor outcrops) area. **C.** Modder River area. **D.** Adamsfield area. **E.** Anderson Creek area. *Viola serpentinicola* only occurs on outcrops near the west coast (circled).

ultramafic geology. Outcrops of serpentinised ultramafics, predominantly of Cambrian age, occur at multiple sites in central-northern and western Tasmania (Gibson et al. 1992). The main concentration occurs approximately along a line from the Savage River ultramafic outcrop between the Heazlewood and Savage rivers, southwards to the Modder River and Hibbs Lagoon, south of Macquarie Harbour (Fig. 1). The unusual soil chemistry that develops in ultramafic soils has given rise to a relatively high degree of endemism (Proctor and Woodell 1971; van der Ent 2015). In Tasmania, recently-discovered species that are endemic to soils derived from serpentinised ultramafics include *Micrantheum serpentinum* Orchard (Orchard et al. 1991), *Epacris glabella* Jarman (Jarman et al. 1991), *Eucalyptus nebulosa* A.M.Gray (Gray 2008) and *Euphrasia amplidens* W.R.Barker (Barker et al. 2013).

The new discovery occurred during a Bush Blitz survey at the headwaters of the Harman River in north-western Tasmania. Careful examination of the *Viola* collections at the Tasmanian Herbarium disclosed the existence of three further specimens filed among other section *Erpetion* species. I am now confident that this is a distinct, endemic species, which I describe here as *Viola serpentinicola* de Salas sp. nov.

Taxonomy

Viola serpentinicola de Salas sp. nov.

***Type*: TASMANIA.** Roaring Mag Creek, approximately 100m upstream of Heazlewood River, 18 Nov 2017, *M.F. de Salas 1894* (holotype HO589960; isotypes: AD, MEL, NSW).

Perennial stoloniferous herb. Leafy stems vertically contracted so that the leaves form a rosette. Leaves with petiole (5–)15–30(–60) mm long, glabrous, often tinged red; lamina (5–)7–15(–20) mm long, (5–)9–20(–25) mm wide, deltoid to rhomboidal, reniform only in etiolated specimens, coriaceous and brittle, discolorous with adaxial surface glossy dark green, abaxial surface paler, base truncate to almost cuneate, often decurrent, margin distinctly crenate with glandular teeth, apex acute to obtuse, rarely rounded, sometimes apiculate; stipules triangular to narrowly triangular, 4–6(–7) mm long. Scapes (10–)30–80(–120) mm tall, glabrous or hirsute; bracteoles near or above the middle of the scape, 4–5 mm long, 0.6–0.8 mm wide, narrowly triangular, sometimes glandular. Sepals lanceolate, 3.5–4.5 mm long, 1.0–1.3 mm wide. Petals discolorous, violet proximally, grading to pale violet at the apices; anterior petal 7–9 mm long, 3–4 mm wide, approximately rectangular to obovate, 3-veined with markedly darker anastomosing veins, the outer veins pinnately divided on the outside only, petal apex truncate to emarginate; lateral petals 6–8 mm long, 2.5–4 mm wide, approximately rectangular, reflexed to moderately twisted, bearded proximally, quantity of beard variable, apex truncate; dorsal petals 5–6.5 mm long, 3–4 mm wide, obovate. Anthers 5, sessile, c. 1.5 mm long, yellow; anther appendages pale brown, c. 1.25 mm long. Pollen creamy-yellow. Ovary pale green with purple mottling, almost solid purple at the apex; style geniculate, c. 1.75 mm long. Fruit green, mottled purple, 6–7 mm long. Seed pearlescent black, c. 2 mm long, 1.1 mm wide, lachrymiform (Figs. 2, 3).

***Selected specimens examined*: TASMANIA.** Fern Creek, on track between Timbertops and Modder River, *A.M.Buchanan*

1924 (HO412158); Brassey Hill, near old nickel mine, *A.M.Buchanan 11633* (HO121152); Tunnel Hill (Serpentine Hill), *M.Wapstra 1295* (HO565182); Harman River. Meredith Range Reglonal Reserve, approximately 4 km north of Parsons Hood, *M.F.de Salas 1279* (HO583942); Waratah Road, W of Heazlewood River, *S.J.Jarman s.n.* (HO583941); Jones Creek. South side of valley, approximately 1.5 km upstream of Heazlewood River, *M.F.de Salas 1888* (HO589962); Track to Bullock's Head, approximately 3 km west of bridge over Heazlewood River, 300m N of Waratah Rd, *M.F.de Salas 1895* (HO).

Diagnostic features: *Viola serpentinicola* can be distinguished from other species in *Viola* section *Erpetion* by the following combination of characters: Plants highly floriferous (Fig. 3A) with often many flowers per clump; leaf lamina thick and coriaceous, normally distinctly deltoid to rhomboidal, often with base somewhat decurrent and apex angular, upper surface glossy, dark green; flowers large and showy, borne well above the leaves, with only slight to moderate bearding on the lateral petals (Fig. 3B, C); seed glossy, black (Fig. 3D).

Phenology: Flowers in spring and early summer.

Distribution and habitat: Known from several disconnected outcrops of serpentinised ultramafic rocks in western Tasmania, from the Savage River area (Fig. 1A), through the Wilson River / Harman River / Serpentine Ridge outcrop (Fig. 1B) to the Modder River, south of Macquarie Harbour (Fig. 1C), a distance of over 100 km. It occurs in heathland and heathy *Eucalyptus nebulosa* A.M.Gray / *E. nitida* Hook.f. woodland. It grows in soils derived from ultramafic geologies in high rainfall areas of western Tasmania, where it is abundant and usually the only *Viola* species present. It is absent on adjacent soils not derived from serpentinised ultramafics, where it is replaced by *Viola hederacea*.

It is absent from other sizable ultramafic outcrops away from the west coast, such as the Anderson Creek ultramafic complex near Beaconsfield in central-northern Tasmania (Fig. 1E), where only *V. hederacea* and *V. cleistogamoides* occur. A survey of the Adamsfield ultramafic complex (Fig. 1D) failed to locate any *Viola* plants. However, a fruiting, depauperate specimen (HO590847) recently collected from serpentinite at nearby Florentine River is mostly vegetatively consistent with *V. serpentinicola*.

Conservation status: Despite its limited geographic range, *V. serpentinicola* is locally abundant and well represented within three reserves: the Savage River Regional Reserve, the Meredith Range Regional Reserve and the Southwest Conservation Area.

Etymology: Named in reference to the substrate on which it occurs, which consists exclusively of serpentinised ultramafic rocks, with the Latin suffix *-cola* (dweller, inhabitant).

Discussion

Viola serpentinicola is morphologically close to other species in section *Erpetion*, particularly to *V. hederacea sensu stricto* and *V. sieberiana* (including *V. hederacea* subsp. *seppeltiana*, VicFlora 2018). It differs from *V. hederacea* primarily in the shape, colour and texture of the leaves, which are soft, pale to mid-green and reniform in *V. hederacea*, compared to coriaceous, glossy dark green and deltoid to rhomboidal with a commonly decurrent base in *V. serpentinicola*. In addition, the lateral petals of *V. serpentinicola* only have light to moderate bearding (Fig. 3C), while the bearding of the lateral petals of *V. hederacea* is generally much denser. The seeds of *V. serpentinicola* are black and somewhat glossy (Fig. 3D), compared to brown for *V. hederacea*. *Viola sieberiana* has similarly shaped and textured leaves to *V. serpentinicola*, though generally rhomboidal instead of predominantly deltoid, and its flowers are smaller, concolorous and pale blue to mauve instead of showy and discolorous with a dark violet center and paler margins. The base of the lamina in *V. sieberiana* is cuneate and strongly decurrent, whereas that of *V. serpentinicola* is predominantly truncate, though sometimes also decurrent. *Viola cleistogamoides* and *V. fuscoviolacea* both differ from *V. serpentinicola* in their comparatively tiny, inconspicuous flowers, and *V. curtisiae* differs in its concolorous cream to pale violet, almost campanulate flowers that are distinctive in the emarginate apex of all the petals.

No other species of *Viola* has been collected from the serpentinised ultramafic areas to which *V. serpentinicola* is confined. However, *V. hederacea* has been collected by the author only metres away from *V. serpentinicola*, growing in Cambrian basalt on the other side of the geological divide. The fact that the two taxa remain distinct when growing in such proximity supports the description of *V. serpentinicola* as a new species.

Figure 2. Holotype of V. *serpentinicola* (HO589960)

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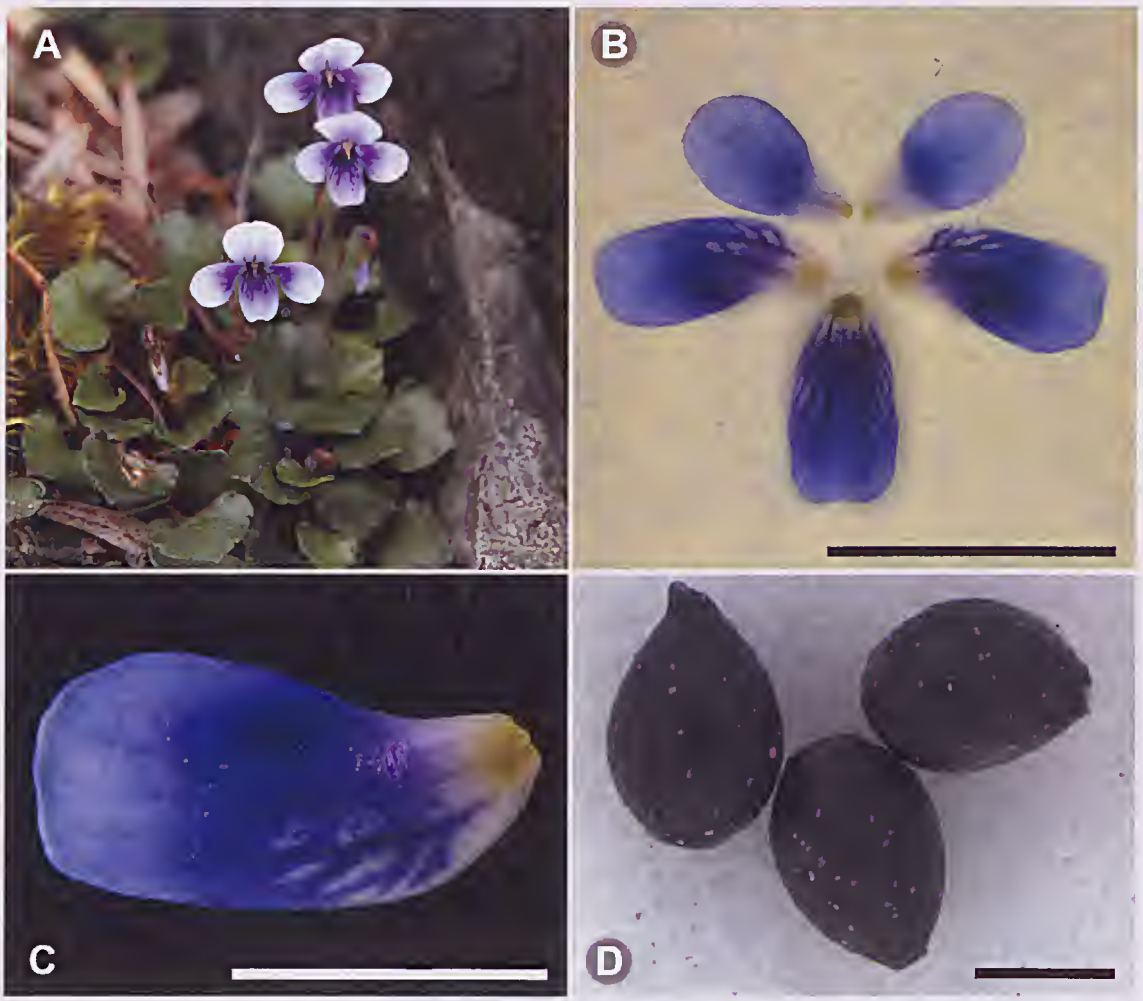

Figure 3. *Viola serpentinicola* flower and seed. **A.** Flowering specimen (*S.J.Jarman s.n.* HO583941) growing in situ. Note prolific flowers on tall scapes well above the basal rosettes. **B.** Petal shapes. **C.** Rectangular lateral petal. Note sparse beard. **D.** Black, glossy, lachrymiform seed.

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Key to Tasmanian *Viola* (adapted from Duretto 2009)

1 Stipules to 4 cm long, green, deeply lobed; plants annual ..... ***V. arvensis***

1: Stipules small, brownish, entire or toothed but not deeply lobed; plants perennial **2**

2 Plants lacking stolons; anterior petal with a short basal spur **3**

2: Plants stoloniferous; anterior petal ± saccate at the base but lacking a spur **5**

3 Leaf lamina deeply cordate at the base; flowering stems ascending, to 30 cm long ..... ***V. caleyana***

3: Leaf lamina with base truncate or shortly cuneate; flowering stems to 18 cm long **4**

4 Leaf lamina broadly ovate to broadly triangular; corolla 5–8 mm long, white with purple veins ..... ***V. cunninghamii***

4: Leaf lamina oblong or lanceolate; corolla 10–17 mm long, purple, violet or almost white ..... ***V. betonicifolia***

5 Corolla cream or very pale mauve, mostly concolorous **6**

5: Corolla blackish-purple to pale violet or discolorous **7**

6 Corolla cream, minute, downfacing, hidden among the leaves, scarcely longer than calyx; leaf bases decurrent, the lamina rhomboid ..... ***V. cleistogamoides***

6: Corolla cream or pale mauve, forward-facing, extending well beyond the calyx; leaf base cordate, the lamina reniform or semicircular ..... ***V. curtisiae***

7 Scapes usually shorter than the leaves; corolla blackish-purple at least in bud, often paler at maturity ..... ***V. fuscoviolacea***

7: Scapes longer than leaves; corolla purple with paler apices **8**

8 Leaves coriaceous, brittle, glossy dark green; lamina deltoid or rhomboidal with acute apex and base decurrent or truncate; occurring only in areas of ultramafic geology on the west coast ..... ***V. serpentinicola***

8: Leaves soft-textured, pale to mid-green; lamina reniform with base cordate (small specimens can have a decurrent base); widespread ..... ***V. hederacea***

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